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Thomas A. Edison Papers

A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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Thomas A. Edison Papers
at
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39

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 39

NOTEBOOK SERIES (NBK-17)

Menlo Park Notebooks, #149 - #184

Menlo Park Notebook #149 [N-80-10-15.2]

This notebook covers the period October 1880. It is a continuation of Menlo Park Notebook #148. The entries are by Edison, Francis Upton, and Francis Jehl. The book contains notes and drawings by Edison regarding tests made of lamps 70-98 from Lot 2. Included also are statistical results by Upton and Jehl along with summaries by Edison and Upton of results from all the lamps in Lot 2. The label on the front cover is marked "Lamps No 2," "No 70-98," "Oct 1880," and "F Jehl." The book contains 284 numbered pages.

Blank pages not filmed: 144-181, 192-257, 260-275, 278-283.

Index.

70

S1

EMF	208 — 210	136 Volts.
R	$\frac{31400}{200}$	157 Ohms
		+ 201
C	48.	5220
	172 — 172	
EMF		
R	$\frac{31400 + 1200}{200}$	
C	16	

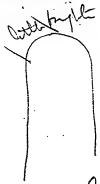
76 nospots !
No blue melamps

$\frac{440}{146}$

314	1644
44	1644
358	6464
179	7471
	7223

Emf	220 - 220 146 Volts
R	$\frac{31400 + 4400}{200} = 179$ Ohms
C	48 + 9 ✓ 5270
E	185 - 185
R	31400 +
	$\frac{31400 + 640000}{2000}$
C	1/6

71.



no blue on clamps

Arc spring Res burned

plat burned off at

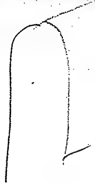
tit Carbon inlaet,

1523
1523
6464
8297

7807

Emf	212 – 214	142 Volts
R	$\frac{25150 + 4400}{200}$	148 ohms
		+ 11 √
C	48	6040
Emf	179 – 179	
R	$\frac{25150 + 5700}{200}$	
C	16	

72 -



very slightly bright -

lets not cracked

No blue on clamps

globe blackened badly

Low -

Res ok - no arc

1673
1673
6464
7399

7209

73

Eu 7	220-222	147 Vots
R	$\frac{31400+4900}{200}$	182 ohms
C	48 5260	+ 7 ✓
Eu 7	189-190	
R	$\frac{31400+6600}{200}$	
C	16	

73-

Blue on Clamps

Arc sprung
Reaction Coil
Burned

lite not cracked

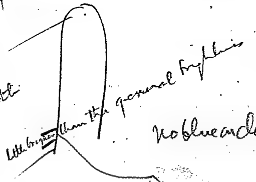
1673
1673
6464
7570

7380

74

E.M.F	220 — 220 147 Volts
R	$\frac{31400 + 3600}{2000}$ 175 ohms
C	44 $\frac{+}{5470}$ 71
	Blue in globe
E.M.F	$\overline{180 - 180}$
R	$\frac{31400 + 5400}{2000}$
C	16

14



Arc sprung burned resistance
but Carbon intact 7 ohm Res
Coil in Martin puts in a 13
ohm Coil - to see what result
It is very blue in globe - no blue
on clamps - Howell says -
globe very black - Lamp goes ok -
I notice black on clamp towards
Positive - arc sprung again but
Carbon ok we put in another
Res Coil - Bursted here arc sprung
Res burned

1206
1206
1206
6464
8153

7029   5040

E.M.F	198 – 198	132 Volts
R	$\frac{2.5150 + 5500}{2000}$	15.3 ohms
C	48	+ 24

E.M.F	170 – 170
R	$\frac{2.5150 + 7150}{2000}$
C	16

75 =

little Unequal

Blue on clamps

bad in clamp - probably
honeycombed negative side ~~[illegible]~~ it
first arc'd & burnt side
off Res then went for
4 or 5 mins & then
arc'd again & busted
short at clamp

1703
1703
6464
7447
7317

76

E.M.F. 222-222 148 Volts

R $\frac{31400 \$45-00}{200}$ 180 Ohms

+ 6

C 4r 53.90

E.M.F. 190-194

R $\frac{31400 + 4500}{200}$

C 16

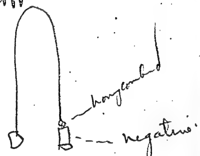
76

little unequal -

It burned the silk off of its resistance but otherwise OK.

~~Bursted~~ Stopped

tits not cracked



Res Coil burned - and fluffy stuff in globe -

Blue on clamps

Put R on again & its burning low

1461
1461
6464
7966

7372

77

E.M.F. 211 - 209 140 Volts

R 31400 + 450 15.9 ohms

C 466 + 201

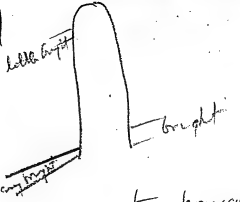
5450

180 - 180

31400 + 2100
2000

C 16

77



twas honeycombed badly
pitts gone between ends fibre

Arc Spring Res Coil
burned - it was not
blue but it had a split
in Clamp = negative side. Carbon intact,
platina leading wire burned
at end of tit

Not blue an clamp

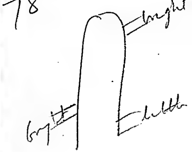
7644
1644
6464
7670

7422

78

E.M.F.	219-220	146 Volts
R	$\frac{31400+2800}{200}$ = 200	171 ohms
C	48	+81
	5530	
E.M.F.	185-188	
R.	$\frac{31400+4500}{200}$	
C.	16	

78



Very blue in globe I notice that it nearly touches side of globe = busted 5 mins after - Resistance burned arc spring - both platina leading wires burned off at tits = Carbon intact = Howell says no blue at clamps = Blackening must be nearly all if not all platina

1523
1523
5464
7095

7105

79

E.M.F 212 − 215 142 Volts

R $\frac{31400\cancel{0} + 3450}{200}$ 174 ohms

C + 13

48

5730

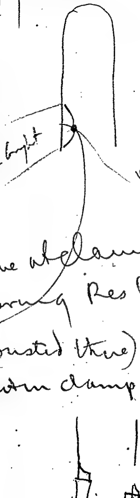
E.M.F 182 − 183

R $\frac{31400 + 5200}{200}$

C 16

79

Shopslip says split in clamp



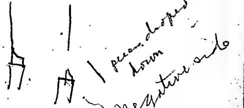
Lots Mercury in globe

Blue at clamp = arc

Spring Res Carbon burned

(busted there) - must been

Split in clamp as its thin



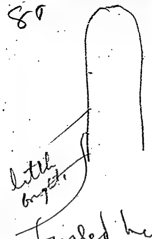
1399
1399
8464
7932

7194

80

E. M. F	209 - 205	138 Volts
R	$\frac{31400 + 800}{200}$	161 ohms
C		+ 171
	5240	
E. M. F	172 - 175	
R	$\frac{31400 + 2700}{200}$	
C		

80



No split in clamps

busted here, -but carbon at clamp badly honeycombed

Burned its Res Coil

arc sprung clamp

towards Pos'n got red hot =

Not blue at clamp

218
222
440
147

314
47
361
131

1673
1673
1673
6464
7423
7233

E.M.F. 218 - 222 147 Volts

R $\frac{31400 + 4700}{2000}$ = 181 ohms

C 48 + 71

5290

E.M.F. 185 - 185

R $\frac{31400 + 6500}{2000}$

C 16

81

Red Spots not blue at C

burned its Res coil of

7 ohms but lamp OK

Martin puts in 13 ohms

notice fuzzy lampblack

from carrying in glass

& in Carbon on side

towards Positive

Started arc = 9

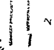
think it was bad

Contact in clamp on negative side arc

Spongy

Clamp quite black towards Positive

W. think was honeycombing



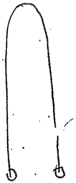
\# 1367
1367
6464
7825
7023

8 2

E.M.F	207 - 205	137 Volts
R	$\frac{31400 + 1600}{200}$	165 ohms
		+ 191
C	48	5040
E.M.F	170 - 172	
R	$\frac{31400 + 3400}{200}$	
C	16.	

82 Slightly Unequal

Not Blue at C



Inside black streak parallel with Carbon connecting to Positive in glass + outside streak parallel to Negative

Res OK - No arc -

Tits not split

195
125
390
120

1139
1139
6464
8113
6855

83

E.M.F	195 – 195	130 volts
R	31400 + 200	158 ohms
		+ 28
C	48	4850
E.M.F	168 – 168	
R	31400 + 2000 / 200	
C	16	

83' – very
Slightly unequal

Not blue at Clamp

No Resin but
acid + glass all
busted

193
195
388
1.29

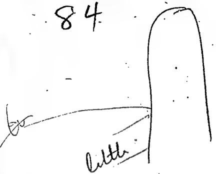
25150
5200
30350
156.7

1106
1106
6464
8041
6717

8,4

E.M.F	193-195 - 129 Volts
R	$\frac{25150+5200}{200}$ = 157 Ohms
C	48 + 29
	4700
E.M.F	167-165
R	$\frac{25150+7000}{200}$
C	16

84



Nat blue at clamp

Res burned

arc sprung

Brushed here Neg side

globe blackened

Neg clamp honeycombed

220
222
(220)
144

1673
1673
6464
7167
6976

85

M.F 220 - 222 147 Volts

R 31400 + 7000 192 ohms

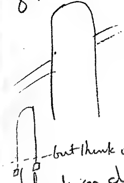
C 48 4980 8√

M.F 190 - 199

R $\frac{31400 + 8700}{2}$

C 16

84



Little! lots Mercury in globe -

Not blue at clamp

but think it broke mechanically

black on clamps towards Positive.

This lamp burned its Resistance but seems to be OK notwithstanding.

Martin puts in a Res Coil of 6 ohm in place of 6 ohms. Arc sprung & burned off platinum wires at tit

Carbon OK = not blue in clamps so says Howell

235
235
570
156

86

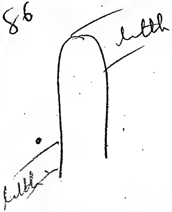
M. F.

R.

C.

48 Too high resistance

86



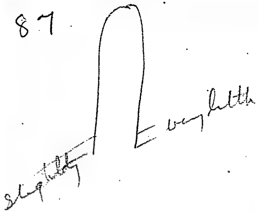
No Res Coil in this
lamp are Sprung
Exploded inside glass
part broke all pieces
blue in clamp -

1903
1903
6464
7471

7741

M.7	235 – 230	B-J-Volts
R	$\frac{31400 + 4300}{200}$	179 ohms
C	48	
	5940	
M.7	195 – 195	
R	$\frac{31400 + 6000}{200}$	
C	16	

87



Carbon intact - glass bursted arc sprung - This lamp had no resistance coil. No blue in clamps

~~Nat~~

1673
1673
6464
7520

7330

220 - 220 147 Volts

$\frac{31400 + 4000}{200}$ 177 ohms

4.8 + 7

5410.

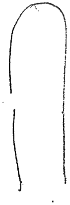
186 - 187

$\frac{31400 + 6000}{2000}$

16

88 — no spots.

Blue at clamps



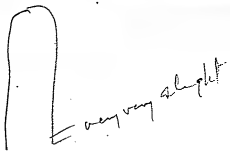
not split in clamp

Res ok no arc..

1139
1139
6464
8326
7068

M.F	195 - 195	130 Volts
R	$\frac{25150 + 4100}{200}$	147 ohms
C	48 5090	$\div$ 26
M.F	166 - 1.66	
R	$\frac{25150 + 5900}{200}$	
C	16	

89 -



Not blue at clamp

Honeycombed at clamp
negative side.

Res burned arc

Spring

not split clamp

1461
1461
6464
7496
6882

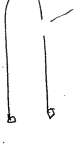
90

E.M.F.	210 - 210	140 Volts
R	$\frac{251.50 + 9500}{200}$	178 ohms
C	48	+ 17
	4880	
E.M.F.	180 - 182	
R	$\frac{31400 + 4800}{200}$	
C	16	

90 no spots

Not blue at clamp

Restarted arc — spray



negative side

1553
1553
6464
7773
7343

91

215 - 215 143 Volts

$\frac{31400 + 2000}{2000}$ 167 ohms

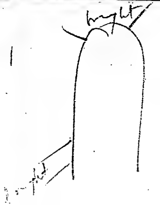
C 48 5420 + 12

186 - 187

$\frac{31400 + 3900}{2000}$

C 16

91

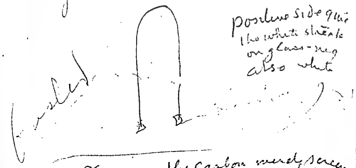


Not cracked in tits

Not blue at clamp

Res 8½ no arc

Globe blackened —



positive side quite the white streak on glass — neg also white

I guess the carbon merely screens the carbon vapor according to which side bursts nothing in it

92

~~2[illegible]~~

~~251 [illegible] + 5 2000~~

~~2[illegible]0~~

~~4[illegible]1~~

Too high resistance

~~185 [illegible] 1 [illegible]~~

~~281 [illegible] 6 [illegible]~~

~~[illegible]~~

92 — very low
no spots

Spots getting bad on this —
after further time spots grow
fearful big must burst soon
Busted

Big blue in Clamp towards positive

~~blu~~

positive — neg

mercury in globe

No Res Coil in this

Carrying towards Positive
tits not cracked

1564
1584
6954
8182
7814

93

215 - 218 144 Volts

25150 + 5200 152 Amps

+101

48

6040

185 - 185

25150 + 6800

2100

16

93 Quite
Unequal

Glass busted - and Resistance
coil burned - Carbon intact.
no blue in 93 at clamps

~~2945~~ 1673
~~2945~~ 1673
~~6464~~ 6464
~~7799~~ 7799
.153 7609

94

220 - 220 147 Volts

$\frac{31400 + 1700}{2}$ 166 ohms

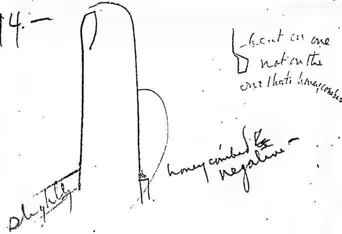
C 48 5760 ~~6170~~ + 71

185 - 184

$\frac{31400 + 3600}{200}$

16

94.—



Right here is a black spot due probably to a little piece of that fuzzy Carbon. a blue halo surrounds it + the inside towards negative

Bushed = Res burned_arc

Sprung = plat was burned off at bits Carbon intact

Blue at clamp

1584
1564
6464
7773
17405

95

215-217 144 Volts

31400 + 2000 167 ohms

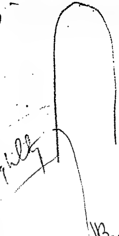
+10√

C 48 5500

185-187

31400-3500

95-



Didnt burn Resistance

no blue in clamps no black --

honeycombed at clamp

Lts not Cracked

1399
1399
6464
7959
7221

96

E.M.F. 208 - 205 138 Volts

R $\frac{25150 - 6800}{200}$ 160 ohms

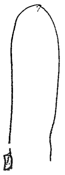
C 48

5270 + 171

180 - 180

$\frac{25150 - 8200}{200}$

96. — no spots



but not inside
where breaks

Shop slip says
Clamps spliced

Black on Clamps towards Pos
Howell says not blue -
Res OK no arc
Globe blackened
~~Not blue~~

lits not cracked

1761
1761
6464
7399

7385

97

225 - 225   150 Volts

31400 + 4900   182 ohms

2000

48

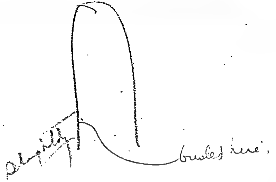
5480

189 - 188

31400 + 6900

200

97



Arc Sprung = only 1 turn on
Res coil, burned Res Coil –
both platina leading wires
burned off at tits

Not blue at C

1.03.8
1038
6464
8539

~~8~~6079

98

190 - 190

127 Volts

140 Runs

$$\frac{25150 + 2900}{200} + 29$$

48

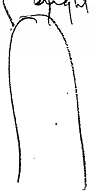
5100

169 - 169

$$\frac{25150 + 4000}{200}$$

98°

Slight



Not blue at C

Res burned are
Sprung platina wire
burned off on. positive tit

Carbon probably
busted mechanically

neg Side

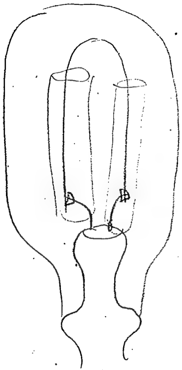
Note -

The first 3 lamps that bursted tonight ~~had~~ no resistance coils = perhaps Resistance on all heated, increased their resistance hence the ones ~~that~~ had no res must have been higher =

The lamps tested tonight were a very nice lot, only 1 or two that are noticeably low + perhaps Res for these was wrong - Apparently there is no oxidation by leakage as I do not notice any noticeable increase in spots =

over

Must look out for cracks in
tits - after test over -



10 good

9 low

5 fair

6 – good
13 low
15 fair
18 low
22 low
29 good
36 little low
37 very good
40 little low
42 low
43 good
46 low
51 good
53 very good

55 extra good
57 good
62 good
67 fair
69 "
70 good
83 low
84 fair
90 fair
98 low

1 fair
2 fair
5 fair
6 good
8 fair
12 fair
13 little low
15 fair
16 fair
18 low
19 good
20 good
21 little low
22 low
23 – good
25 good
28 good
29 good

30 good
32 fair
33 good
34 good
35 fair
36 little low
37 very good
39 very good
40 little low
41 very good
42 low
43 good
46 low
50 good
51 good

53 – very good
54 Extra good
57 good
62 good
63 good
64 fair
67 fair
69 fair good
70 good
71 good
72 good
73 fair
75 fair
76

82 good
83 low
84 fair
88 good
89 fair
90 fair
91 good
98 low –

Lamps that became
bright

Lot 2			Lot 1
37			40
43			47
51			91
53			1
57			
69			
98	43	29	
40	51	22	
42	53	13	
53	57	36	
57	67		
69	69		
84	83		
98	84		
37	87		
40	98		
42	18		

Badly Spotted no 84

~~Shese~~ These 4 came in order named

Blue at the clamps?

Lot 2

13

18

22

29

42

83

87

98 filled with very blue fluorescence.

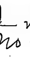
Burst + burnt the resistance up

✓ 83 Burst - arc at clamps
no outside resistance in

13
18 Blue at clamps
22
29
42
67
87

Oct 15 - carbon not broken
✓ 36 Burst - arc below the
clamp. Fused platina wire
fls O.K.

✓ 87 Burst, arc at clamps

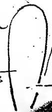
✓ No 40 Broke - arc at clamps
resistance burnt off  negative No 2 Lot.
Oct 16.

✓ Lot-1 Oct-16 Res OK"
No 1 - carbon broke at
7.35 a.m Oct 16 1880 negative

No. ~~90~~ 88 Lot-1 Oct-16 at 8.10 a.m
✓ Res OK"
Carbon broken here.

No 67 Lot-2 Oct-16 positive
✓ 8.13 A.m
arc, Clamp fused,
resistance burned 890 / 13 / 903

Oct-16.
✓ No 29 Lot 2 8.22 A.m 890 / 22 / 912
Res O.K.



negative
broken here

No 37 – Lot 2   829 A.M.

Oct 16.

negative

890
29
919

No 42 – 8,35 A.M. Oct 16

Lot 2

half way broken here.

890
35
925

Oct 16

No 43   9.50 A.M.

890
50
940

Lot 2

carbon broken positive

Res O.K.

53 Lot 2.

Carbon broken

--- negative.

Res. O.K.

9.20 A.M. Oct 16

950
20
970

No 22 Lot 2

1070
60
1130

Oct 16.

Carbon broke at 11.40 A.M

Res. O.K.

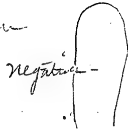
--- negative this was very badly spotted blue at clamp & a few minutes before it went Mr Edison noticed it.

✓ No 69 Lot 2

1130
52
1182

11,52 a.m. Oct 16.

carbon broken



Res O.K.

No 47 Lot L

11,30 P.M Oct 16 –

carbon broken

Res burnt

✓ No <u>18</u> <u>Lot - 2</u>

2.30 P.M. Oct 16

Carbon broken Positive

No resistance

$$\begin{array}{r} 1190 \\ \underline{30} \\ 1220 \end{array}$$

1

$$\begin{array}{r} 1310 \\ \underline{5} \\ 1315 \end{array}$$

\# 13. Lot 2.

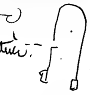
4.05. P.M. Oct. 16.

(A lamp on which Edison was experimenting was short circuited, the "<u>recoil</u>" broke #13.)

All in a heap.

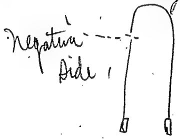
No resistance.

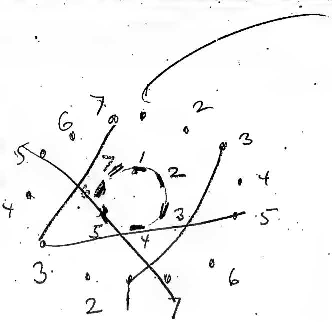
51 Buckled at 4.45
Oct 16 1880

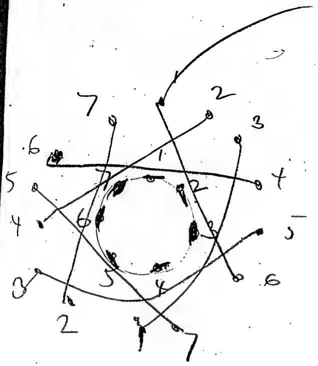


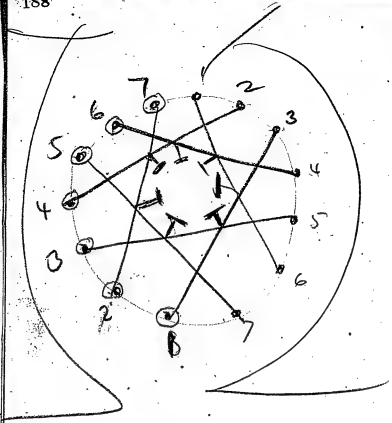
1310
45
1355

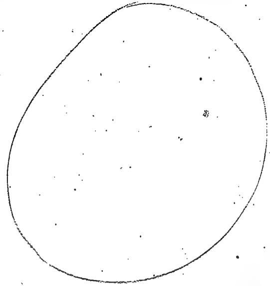
No 40 Broke Monday morning
Oct 18 - when the engine started

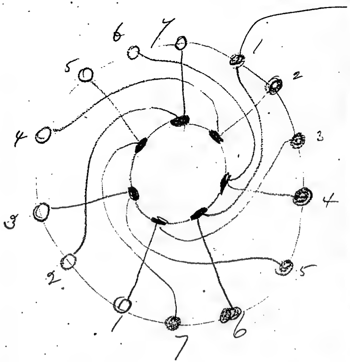


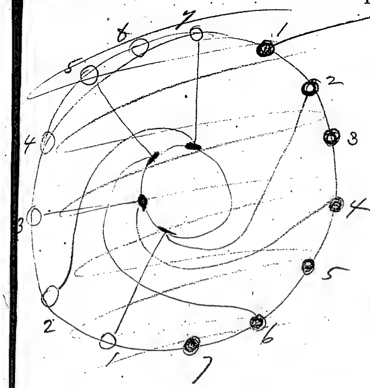


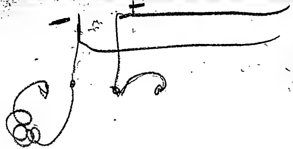


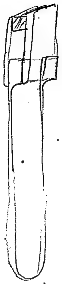

7
2
6
3
5
4
4
5
0
6
2
7
8




1
2
3
4
5
6
7
1
2
3
4
5
6
7


1
2
3
4
5
6
7
1
2
3
4
5
6
7





48
52
100

310
310
620

2.1.6
432
1273
13362

21.6) 125 (58
1080
1700
1728 290

26
16
13
16
7
10
16

7 | 104 | 14
7
34
28

Menlo Park Notebook #150 [N-82-12-21]

This notebook covers the period December 1882-May 1885. The entries are by John Ott, E. D. Kellogg, and H. de C. Hamilton. There is also one entry by Edison on carbon filament experiments. The name of Martin Force appears as a witness. Included are notes by Ott on experiments with carbon filaments, clamps, vacuum pumps, and electric meters. There are also notes by Kellogg and Hamilton on insulation experiments and notes by Hamilton on condensers, storage batteries, chemically treated wrapping paper, and bleaching by electricity. The label on the front cover is marked "Sept 4 80." The book contains 264 numbered pages. The last few pages have been torn out of the book.

Blank pages not filmed: 182-183, 190-264.

2

Dec 21 1882 To 3

Tips of Carbon filaments Carbon)

~~Lampblack & Sugar~~ dont hold on filament. ~~porous~~ hard Carbon

Lampblack & Rosin good Carbon holds well — not as well as Lamp Black and Tar J. F. Ott
MNF

Lampblack Syrup & Anthracene dont stick ~~to~~ Carbon at all - porous Carbon
J. F. Ott

Lampblack & Pitch - porous no good —

TOS.

Dec 21. 1882

Lamp black and Tar
quite good adhears to
filement. J. F. Ott.
M. N. F. [illegible]

Dec 21. 1882

Lamp Black Gum copal
Pulp Paper & Burnt Gyp

Nothing left

TAE
M. N. F.

Pitch and Tar

Very good

Lamp Black & Antracon

Nothing left TAE
J. F. Ott
M. N. F.

Plumbago & Pitch

Nothing left

TAE
M N F

Plumbago & Syrup

Nothing left

Plumbago & burnt sugar.

No good

Plumbago Syrup & Anticine

fair TAE
M N F

Plumbago & Anticine

No good

Plumbago & Syrup

No good

TAE J. F. O. H.
M. N. F.

Dec 28, 1882

Carbonized ~~[illegible]~~ Manila fiber twisted found it worked well carbonized hard glosy black.

J. F. Ott
M. N. T.
TAE

Plumbago. Tar & Pitch
fair

TAE
M N T
Jan. 6 1883

Carbonized Bambo fiber in Linseed oil brought up to temperature of 600 deg Far, worked well
Also Mella fiber

J. F. Ott
M. N. T.
TAE

Jan 16, 1883

Made clamping device to clamp fiber so as to solder it to copper wire of inside part of lamp without heating Carbon above the thick part

Soldered one with silver

" one with Tin

Also soldered with the current using the wires as conductors then braking them forming an Arc fusing the metals together also using two carbon pencels forming an Arc. Also found that one pencel works well

Joe
J. F. Ott
M 22F

Jan 16. 1883

Plated ends of fiber then tined them, Also tined end of Copper wire, then soldered them together with soldering Iron

J. F. Otto
M. N. F.
JMc

Jan 11. 1883

Twisted Manilla Fiber put in moulds and sent to Lamp Factory Newark to be Carbonized.

J. F. Otto
M. N. F.
TAE

Jan 11, 1883

Made up a mould of Carbons and laid side by side with the fiber a thin filiment of lead about twice the diameter of the Manilla twisted fiber, When the fiber Carbonized the molten lead combined with the

oxygen given of by the fiber or other substance in the mould therefore the fibe will be saved

Also tried Zinc
" " " Copper
" " " Iron
" " Tin foil

John F. Ott
M N F
TAE

Jan 16, 1883

Soked Carbon moulds in Linseed Oil, boiled then then put in fibers and Carbonized.

J. F. Ott
M. N. F.
TAE

Jan 18, 1883.

Made up a lot of fibes laid out straight with one fiber twisted around them Also three fibers braided together, Also six fibers as three some braided tight some loose

J. F. Ott
M. N. F
TAE

Jan 18, 1883

Made a device for holding carbon and inside parts while admitting them to the flame for soldering and soldered them with differ grades of silver solder

J. F. Ott
TAE
M. N. F

Jan. 24. 1883

Sent 54 Manilla twisted fiber to Lamp Factory to Carbonize they were twisted some Two Three Four Five. and Six then doubled and twisted again

J. F. Ott
TAE
M. N. F

Also braided same
Also laid Four and five fibers straight and twisted one fiber around in one direction and one in the other

TAE M. N. F

Jan 26. 1883

Sent another lot to Lamp factory they Carbonized well

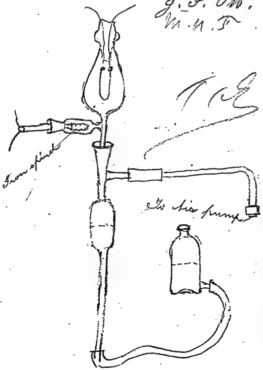
J. F. Ott
Mc E
M. N. F.

Lamp Exp   Feb 3. 1883

Had glass blower make the following device per order of T. A. Edison.

J. F. Ott.
M. N. F.

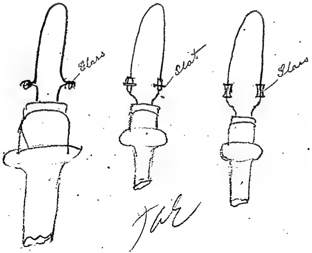
T A E



Lamp Exp   Feb 5, 1883

Plated Carbon filement on both ends, then drawn small glass tubes sliped them over the plated part also the inside parts then fused them together

J. F. Ott.
M. N. F



TAE

Lamp Exp Feb 10 1883

Twisted Manilla fiber tied them over a forms, then incarsed lower part in Constrated sugar before Carbonizeing them

J. F. Ott
[illegible]
M N F

Feb 12, 1883

Finished Machine to twist very fine wire around end of fiber and inside parts so as to make a perfict contact between inside wire and of fiber

J. F. Ott
[illegible]
M N F

Lamp Exp

Feb 12, 1883

Twisted fibre, put in moulds, and sent to lamp factory for Carbonizing.

J. F. Ott.
Edison
M. N. J.

Feb 12, 1883

Taken a solution of bastoline mixed by Mr Edison incrused end of fiber so as to enlargen the end where contact is made to Copper wire.

Also incrused tissue paper then wound the end

J. F. Ott
T. A. E.
M. N. J.

Lamp Exp Feb 13, 1883

Made small devise for twisting end of Copper wire on inside parts a taper spiral forming a cup shape to hold fiber untill plated together

J. F. Ott.
TAE
M. N. F.

Feb 19. 1883.

Coated ends of fibers with Bassorin Marked Order No 2.

TAE

Feb 20. 1883

Coated ends of fiber with Bassorin marked Order No 4.

TAE
M. N. F.

Lamp Exp Feb 20. 1883

J. F. Ott

Sent Tin brushes with Iron wire to Mr Andrews to be tested on Dynamo for Carrying capacity, Heat and Spark

TAE

Feb 20. 1883

Lamp Marked Order No 1

A. Copper wire twisted in spiral shape then reamed out and fiber pressed in.

TAE

Feb 20, 1883

Order No. 6. South American fiber twisted 8 strands

TAE

Lamp Exp

Feb 20, 1883

Order No. 7. fibers with enlarged ends with Barsorin disolved in equal parts Water and Amonia

F. A. E.
W. H. F.

Order No 5. ends imearsed in ~~sugar~~ before carbonizing

F. A. E.
W. H. F.

Order No 8
the endire length of fiber saturated with solution marked Order No 2

F. A. E.
W. H. F.
J F Otto

Lamp Exp Order No 2

Tragacanth water & Amania on end of fibers

T A E
M N F
J F Ott

Order 3

T A E
M N F

Tragacanth & Amania strong on end of fibers J. F. Ott

Order No 4

T A E
M N F

Bassorin

Tragacanth treated with water untill swelled up then poured off, somore water used untill all the

solible Stuff gone away
~~then~~ treated with alchol
acutated with Hydrochloric
Acid then pressed to squease
it out & then dissolved by
heat in strong Amonia
See Bossorin 1X of
Thease fibers were only
treated on ends to unite
all fibers as one J. F. Ott
M N F
TAE

Lamp Exp Order No 9

The entire lengths of fiber
treated with solutions marked
Order No 2 TAE
M N F
J F Ott

Order No 10

The entire length of
fiber treated with
solution Marked Bossorin
Order No 4. TAE
M N F
J. F. Ott

Order No 11

J. F. Ott

The entire length saturated with solution marked No 3 Amonia strong

TAE
M. N. F

Order No 12

Two fibers double straight coted with solution marked Order No 2

TAE
M. N. F
J. F. Ott

Lamp Exp

Order No 13

Two fibers straight TAE
coted with Order No 3

TAE
TAE

Order .14 . March.
3. 1883

Fiber coated with bassorin,
eight in number, drawn through
draw plate put on foot of
bristol board TAE ~~J F Ott~~
M N F

Order .15 TAE
M N F

Twisted fibers with foot on
ends made of card board and
fastened with bassorin

J. F. Ott March 3.
M. N. F TAE 1883

Lamp Exp — March. 5, 1883

J. F. Ott

Saturated Gum Tragacanth in water untill soft put in a Syringe and forced out in shreads and ~~left~~ dry, Then cut grove in with saw and sliped fiber in with some moistened Gum, put in moulds and sent to Lamp Factory for Carbonizing.

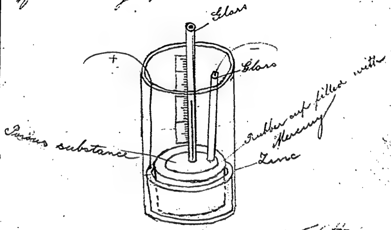
TAE M.N.T.

March 6. 1883

Made carbon clamp by winding the wire on a flat ~~mandrill~~ mandrill then placing a flat wedge alongside the carbon

March 6, 1888

Made Meter after the following principle

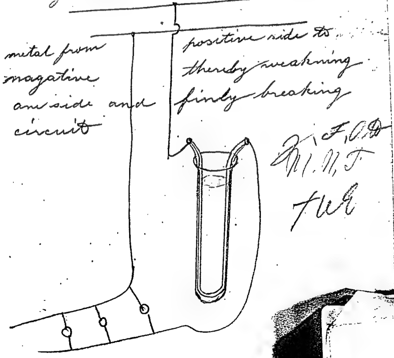


J.F.O.H.
M.W.F.

JKV

Motor Exp   March 6, 1883

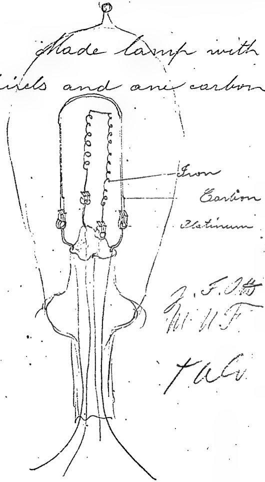
Made safty plug in following manner, the object being that part of the current flowing through the solution carring some of the



F. O. D
M. N. T
FUE

March. 6. 1883

Made lamp with two spirals and one carbon



J. F. Ott
M. N. F.

TAE

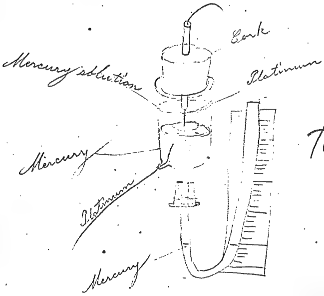
March 8, 1882

Made lamp with Aluminium clamps and leading wires

MNF

March 8, 1882

Lamp made Meter after the following principle

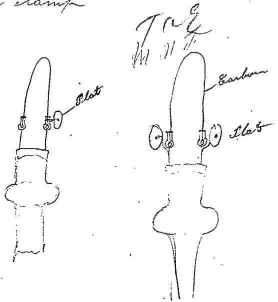


TAE

MNF

March 9, 1883
J. F. Ott

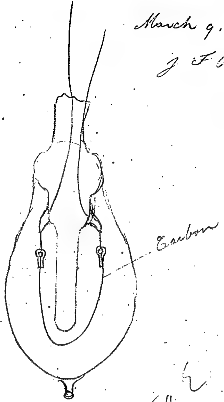
Made lamps 2 with one platinum plate one side of clamp, and 2 with plate on each clamp



Lamp Exp

March 9, 1883

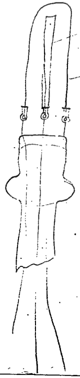
J F Ott



Edison v Thomson } Edison's Exhibit F

March 9, 1883

Made lamp with soft Iron plate between carbon loops



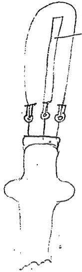
Lamp Exp

Edison v Thomson } Edison's Exhibit C

March 10, 1883

J F Ott

7/11/[illegible]

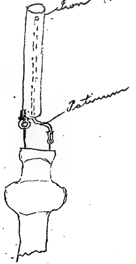


Carbon x
Aluminium x
Zinc x
Tin x
Lead x
Magnesium x
Platinum x
Copper x
Silver
Phos bronze
Babbit
Nickel x
Gold x
Silver fine
Oxidized

March 12, 1883

Made an experiment by sealing in a lamp bulb an Iron tube conected to one pole piece of platinum wire to other pole but not in conection with each other

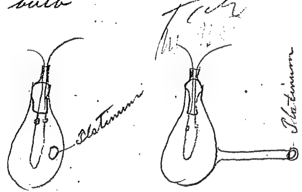
TAE J. F. Ott
M N F



March 12, 1883

J. F. Ott

Made two lamps with piece platinum blown in side of bulb



Clamps to clamp
Carbons in Lamps

March 16, 1883

Hammered platinum wire, then drawn through draw plates, leaving small hole in end to put fiber in, fastened fiber with lamp black and coal Tar, then coated the entire wire with lamp black & Tar, baked, untill gasses evaporated, Then immersed carbon in water, gently blowing flame on clamps, and socket ~~and~~ fully carbonizing the compound

J.F.O.tt
John W...

Lamp Exp

March 19. 1883
J. F. Ott

Mixed sugar and lamp black, carbonized found it to blister

Mixed lamp black and Karocene, Crumbled off

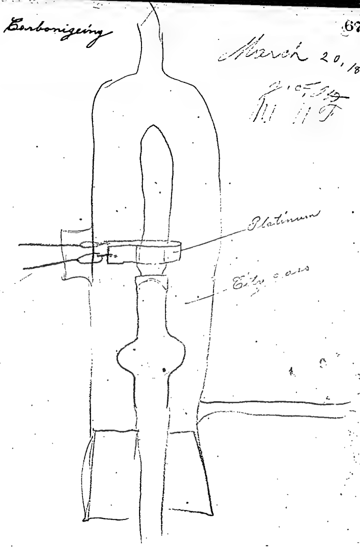
Mixed lamp black and Linsed oil, crumbles off

Tar and Graphite sticks quite well, difficult to aply

TAE

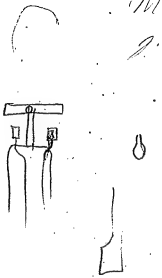
Carbonizing

March 20, 1883



 March 20 1883

M, N, T
~~J. F, Ott~~



March 21, 1883

Made device for clamping carbons and plating hydro carbon on lower ends by imearsing in oil, and passing current through

March 26, 1883 J.F.O.
W.H.F.

Made two lamps with gold leaf between loops

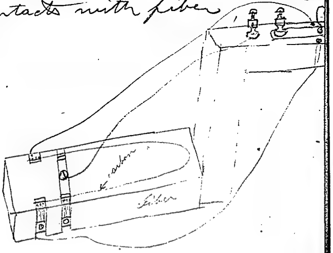
March 27, 1883

Altered clamping device to following principle

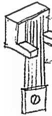
1 having clamping device laying flat so that carbon can readily be handled,

2 second the springs being made of wire instead of sheet so as to make a larger number of

contacts with fiber



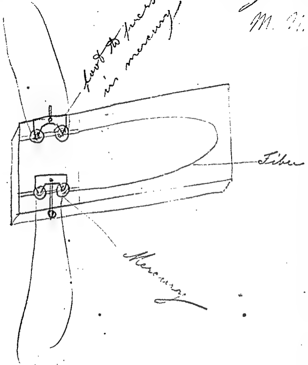
J. F. Ott.
M. N. F.



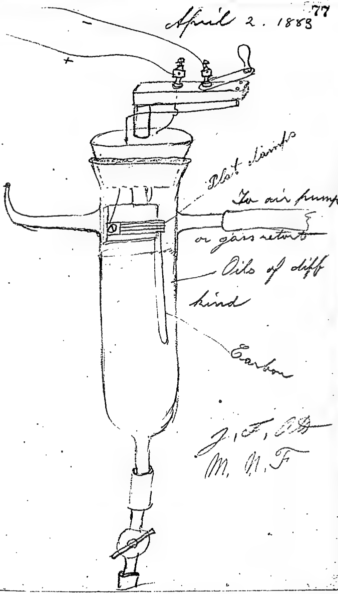
Carbonizing or Depositing Hydro Carbon on lower part of fiber

March 27, 1883

J. F. Ott
M. N. F



April 2. 1883

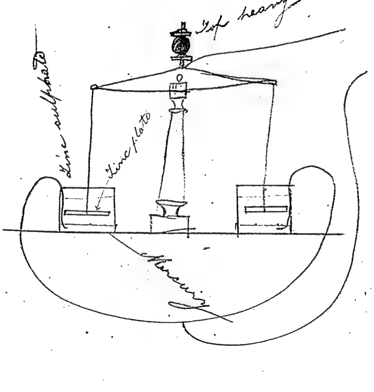


J. F. O.
M. N. F.

April 3, 1883

J. F. Ott
M N T

Made and tested meter

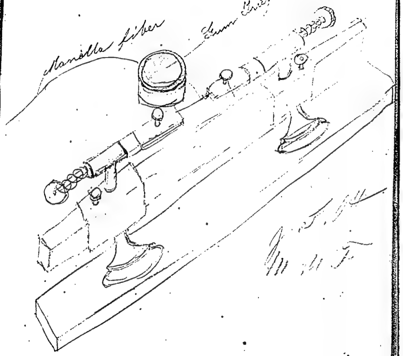


April 3, 1883

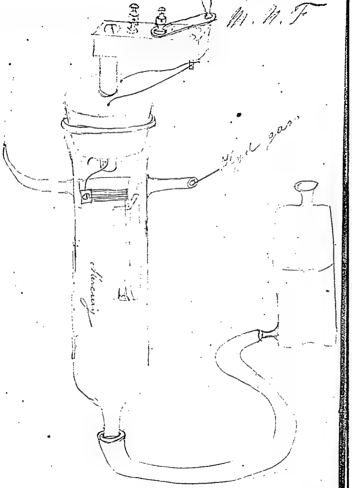
Drawn Manella fibers
through Gum Tragacanth
tied over a form left dry
cut of different grasses that
were hollow split one side and
sprung over fiber and fastened
with Gum Tragacanth

J. F. Ott
M. N. F.

April 4, 1883



J. F. Ott
M. N. F.

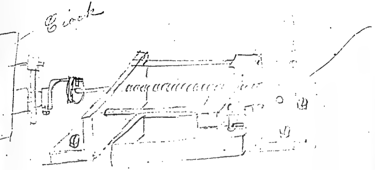


Made small clamps by flatining plat wire then drawing through draw plate small enough to take fiber without parts then sliping sleeve over to spring clamp together and being large enough to radiate heat & prevent temperature raising to red heat

[illegible]

[illegible]

April 12, 1883
J. F. Ott
M. M. F.



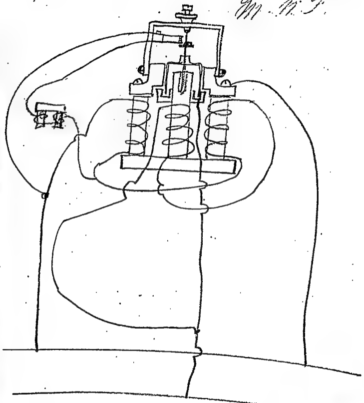
Tested this Model, and it give quite fair results

For making Carbon fibre by Hydrocarbon deposit

Meter

May 17. 1883

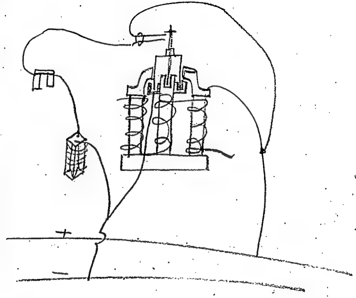
J. F. Ott
M. N. F.



Meter

May 17, 1883

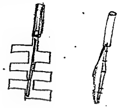
J. F. Ott



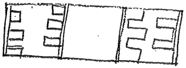
May 17, 1883

J. F. Ott

M. N. F.

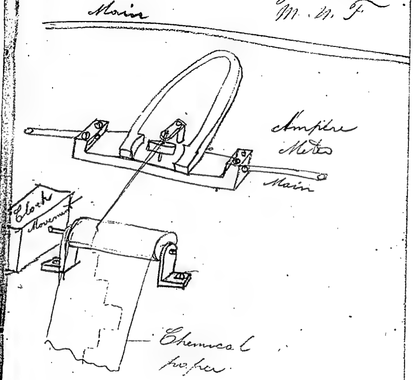


Fan



Dash pots
for Meters

June 4, 1883
J. F. Ott
M. N. F.

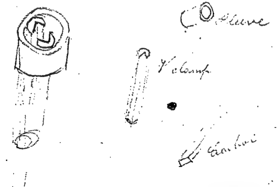


June 14, 1883

M, N, F

Had Bergmann make rolls

To make clamp to hold bamboo Carbons known as Village plant Carbons and also sleeve to slide over them the wire was rolled V shape, and sleeve round



J. F. Ott

July 9, 1883
M, N, F

Found that a solution of Permanganate Potass made a very clear mark on paper while the Permanganate Potass fades and the mark remains perminent.

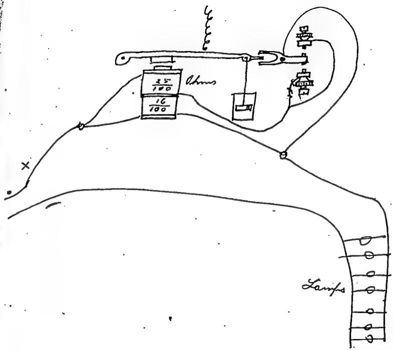
Good for rapid telegraph

J. F. Ott

Meter

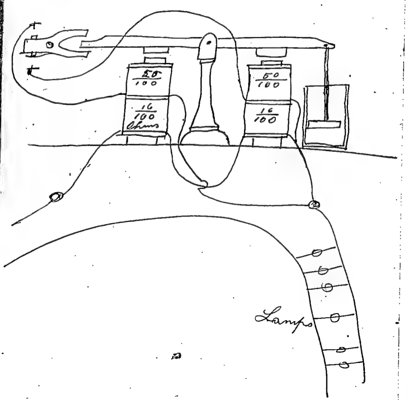
July 24. 1883

J. F. O



Meter

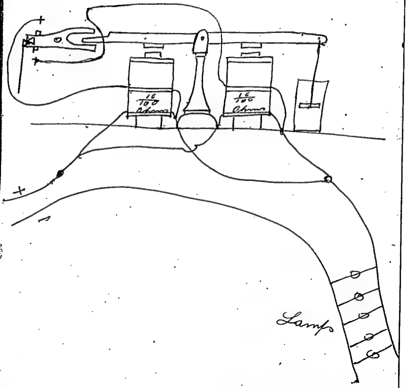
Aug 3. 1883
J. F. O



Meter

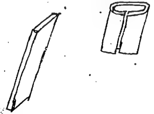
Aug 3. 1883

J. F. Ott



Aug 6, 1883
J. F. O
M. N. J

Made clamps by rolling round copper and Platinum wire flat and sealing them to Platinum wire on Inside parts of lamp then making flat sleave to sute, different withs to take carbon with foot or without.



Sizes of wire used on page No. 111.

J. F. Ott   M. N. F

Size of copper wire used for making new clamps (Large size) on platinum

.016 Wire will make clamp
.003 Thick
.051 wide
.080 Will make sleeve for clamp
.010 Thick
.110 Wide
.150 Length to cut ~~clamp~~ sleeve

1 Die .072
1 Punch .072
1 " .052
1 Core {.052 wide / .012 Thick}

Small Size
.012 Wire will make clamp
.003 Thick
.030 Wide
Same size wire used for sleeve except that they are cut shorter
.096 Length to cut sleeve

1 Die .052
1 Punch .052
1 " .031
1 Core {.031 wide / .012 Thick}

Aug 21.1883

Bought tisue paper to make Carbon fillements of, by paisting a number of sheets to gether and cutting out the required sizes bending them then Carbonizing them

J. F. Ott

EDKellogg Aug 25. 1885

Mixed different oils with different Compounds to make Insulation Compound

Hemlock Gum & Rosin. very brittle

Tar & Burgundy Pitch very fair

Resin & Chalk no good very brittle

Hemlock gum & chalk no good very brittle

Tar & Starch very fair quite hard

Tar & Chalk too soft did not put enough chalk in

Tar & Resin Got too much tar in made it to soft

Resin & Fusel Oil. made it with too little oil at first then got too much in could be made very good I think

Hemlock Gum & Linseed Oil. would be very good without much Oil put in too much

Gum Damar & Raw Linseed Oil. — good
" " , Fusel Oil & Resin. — good
" " & Oil Cade. — too brittle
" " & Cotton seed Oil — gummy.
" " & Castor Oil — too soft but [illegible]
" " & Paraffine Oil. — fair
" " , Resin & Chalk. — brittle.
" " , Flour & Castor Oil. — fair
Burg Pitch & Linseed Oil. — too soft.
" " & Cotton seed Oil — too soft
" " & Castor Oil. — too soft.
" " , Linseed Oil & Chalk, too thin
" " , & Paraffine Oil — fair.

E D Kellogg Aug. 25 1883

Resin + Linseed Oil Brittle
" " " with more oil
good but too soft

Resin + Paraffine Oil soft
Put in too much Oil

Tar + Hemlock gum good but
somewhat Brittle could better it
by adding a little Oil

Hamilton Aug. 27" 1883.

Gum Myrrh & Castor Oil. — won't mix
" " & Linseed " — " "
" Zanzibar & Castor Oil. — won't mix well.
" Copal & Castor Oil — very good.
" " & Linseed " — ~~too~~ brittle
" " & Cotton seed Oil. — too " .
" " & Olive Oil — brittle.
Gum Sandarch & Castor Oil — very good.
" " & Linseed Oil. — brittle N.G.
" " & Cotton seed " — " N.G.
Gum Amber & Castor Oil — won't mix well.
" " & Linseed Oil. — " " .
Gum Benzoin Castor Oil. — fair but brittle
Gum Zanzibar & Castor Oil. — too soft.
Gum Copal & Castor Oil. — good.

EDisonKellogg Aug. 27 1883

Resin Tar + Linseed oil good
but soft

Resin, Hemlock gum + Cottonseed Oil
good but somewhat Brittle

Resin + Cotton-seed Oil good but
little bit to soft

Hemlock gum & Cottonseed oil
very soft

Hemlock gum & Castor oil
very soft EDKellogg

Hemlock gum Castor Oil + Gum Myrrh
very soft, gum myrrh did
not mix with other things

Hemlock gum & Paraffine oil
good but brittle
with more oil, two soft

Hemlock gum & Oil Cade
very brittle add more Oil

Red Lead Resin + Linseed Oil
very Brittle
with more oil still brittle

Hamilton. Aug 28" 1880.

Gum Damar & Castor Oil. - fair. this time.
" " & Paraffine Oil. - too much gum.
Burg Pitch & Castor Oil. - fair
" " & Paraffine Oil. - too brittle
" " & Cotton seed Oil. - gummy.
Gum Zanzibar & Castor Oil - won't mix well.
" " Castor Oil & Sulphur. - no good.
" " Cotton seed Oil. - won't mix
" " Linseed Oil. - gum won't disolve.
" " & Oil Cade. - won't mix well.
Burg Pitch & Petroleum wax - too brittle
Zanzibar, Tar, Sulphur & Castor Oil - N. G.
Gum Damar & Petroleum wax - too brittle

Red Lead & Tar. very good

Red Lead, Resin & Castor Oil -
very Brittle tried 2 all brittle

Red lead Resin + Paraffine Oil -
tried 2 grades all brittle

Chalk Resin & Paraffine Oil -
very good

Chalk Resin + Castor Oil -
very good E D Kellogg

Hemlock gum & Olive Oil -
good but soft

Resin + Olive Oil - Brittle

Gum Ammoniac & Castor Oil
no good gum dont mix with
oil

Gum Olibanum Red lead + Linseed Oil
no good gum dont mix will
oils.

Hamilton. Aug. 29" 1882.

Gum Zanzibar & Oil Myrbane. — N.G.
Burg Pitch & Oil Myrbane. — fair but too soft
Benzoin, Oil Myrbane, & Petroleum wax, & Fire Clay — will not mix well.
Asphaltum & Petroleum wax — fair a little soft
" Petroleum wax & Clay — too thin.
Hemlock Gum & Oil Myrbane — good
Aloe Capens will not disolve in Oils.
Balsam Tolu & Castor Oil. —
" " & Linseed Oil — brittle. N.G.
" " Linseed Oil, Clay & Tar — brittle
" " & Petroleum wax — too brittle
" " Petroleum wax & Tar — " "
" " & Tar — rather good.

Gum Zanzibar + Anilin Oil - N. G.
" Damar + " " - pretty good
" " + Oil of Tar - fair, a little brittle
Burg Pitch + Oil of Tar - a little brittle
" " + Anilin Oil. - " "
Catchu + Castor Oil, wont mix at all.
Read Lead + Petroleum wax - too soft.
Fire Clay + Oil of Tar - N. G.
Balsam Tolu + Oil of Tar - fair, a little soft.
Resin, Chalk, + Oil of Tar - too brittle.
Balsam Tolu + Anilin Oil. - not
tough enough.

Aug 29 1883 EDKellogg

Resin - Linseed Oil fair - too soft.

Asphaltum + " " very good

" + Oil Myrbane good

" + ~~Castor~~ Oil wont mix

" + Olive Oil fair too soft

" + Paraffine Oil very good.

" + Cotton-seed Oil fair

~~Resin~~

EDKellogg

Aug 30 1883

Asphaltum + Aniline Oil fair
" + Oil Tar good
Resin + Aniline Oil brittle
Resin + Oil Tar good.
" + " Myrbane good
" + Petroleum wax too Sticky
Aniline Oil + Hemlock gum good

EDKellogg

Sept 3 1883

Gum Camphor + Aniline Oil dont mix
" " Aniline Oil + Resin good
Gum Arabic + Oil Myrbane dont mix
Gum Camphor Oil Myrbane + Resin too soft
" " Palm Oil very good but little soft
" " Paraffine Oil + Resin very good
" " Linseed " + " very fair
" " Oil Tar + wood Tar good
Tar + Oil Myrbane good
" " " + Sulphur fair
" + Aniline Oil good
" + Palm " N. G. dont mix

E D Kellogg

Gum Thus & Castor Oil - not tough enough
" " & Linseed " - " " "
" " & Cotton seed Oil. - too gummy.
" " & Paraffine Oil. - " "
" " & Aniline Oil. - too brittle
" " & Oil Myrbane. - " "
" " & Oil of Tar - too brittle
" " & Petroleum wax. - too soft.
" " & Palm Oil - brittle.
" " & Copal Varnish. - too brittle.
" " Copal Varnish & Sulphur - brittle
" " & Oil of Nutmeg. - too thin
" " Oil of Nutmeg & Sulphur - brittle
" " & Tar - a little too soft.
" " Tar & Sulphur - " "

Gum Euphorbium + Oil Myrbane - dont mix
" " + Aniline Oil - " "
Resin + Palm Oil - very good
" + Copal Varnish - rather brittle
" + Oil Nutmeg - rather too brittle
Hemlock gum + Palm Oil - good but too soft
" " + Oil Nutmeg - good averaging 2
" " + Copal Varnish very good
" " + Oil Tar - good but not tough
" " + " Myrbane - good averaging 3
Asphaltum + Copal Varnish - good
" + Oil Nutmeg good averaging 2
" + Palm Oil good " 2

Gum Damar + Copal Varnish. — a little soft
" " + Palm Oil — too sticky.
" " + Oil of Nutmeg — too brittle
" Sandarch + Copal Varnish — a little soft.
" Benzoin + " " — won't mix.
Burg Pitch + " " — brittle.
Balsam Tolu + " " — brittle

Sept 5 - 1883

Gum Assafoetida & Oil Myrbane - dont mix
Asphaltum & Petroleum Tar - not tough enough
Hemlock gum & " " - too soft
Asphaltum & Aniline Oil - not tough enough
Aloes Succotrine & Aniline Oil - Brittle
" " & Oil Myrbane - dont mix
" " & Castor Oil dont mix
" " & Palm Oil dont mix
" " & Oil Tar dont mix
" " & Linseed Oil dont mix

E.D. Kellogg

Balsam Tolu + Palm Oil. – very brittle
" " + Paraffine Oil. – " "
" " + Cotton seed Oil. – " "
" " + Oil Myrbane. – not tough.
" " + " of Nutmeg. – too brittle
Burg. Pitch + Palm Oil. – " sticky.
" " + Oil of Nutmeg – too brittle
Gum Sandarch + Aniline Oil. – brittle
" " + Oil Myrbane. –
" " + Oil of Nutmeg – too brittle
" " + Palm Oil – wont mix well
" Senegal + Aniline Oil. – no good
" " + Castor Oil. – " "
Catchew + Aniline Oil – not tough.

Hamilton. Sept. 6" 1883

Gum Thus + Linseed Oil, mixed with gutta Percha dissolved in Carbon bisulphide.— very sticky.

Gutta Percha + Gum Thus dissolved together in Coal Tar.— good, and very tough.

Gutta Percha + Gum Thus dissolved together in Coal Tar + Sulphur — quite brittle.

Gum Thus, Linseed Oil + Litharge.— very brittle.

Burg Pitch, Aniline Oil + Litharge — very brittle.

Gum Damar + Gutta Percha dissolved together in Coal Tar — a little brittle, not tough.

Gum Damar dissolved in Castor Oil + then mixed with Glue dissolved in Acetic Acid — very soft and sticky.—

Jn.

Sept 6 1883

E D Kellogg

Acetic Acid Sol of Glue and Oil Myrbane dont mix but Glue gets tough as it gets cold.

Acetic Acid Sol. of Glue aniline oil & Hemlock gum mix but dont get hard

Tar Starch & Gutta Percha does not get tough

Tar Gutta Percha Asphaltum Petroleum wax & Oil Myrbane gets hard but not tough

E D Kellogg Sept 7 1883

Acetic Acid Sol. Glue, mixed with Asphaltum - no Good not tough

Acetic Acid Sol. Glue & hemlock gum & Aniline Oil - too soft

Acetic Acid Sol Glue + Asphaltum + Cotton Seed Oil - dont mix well not tough

Tar Asphaltum Hemlock gum + Copal gum — not tough

Tar Asphaltum gum Copal & Sulphur — not tough

Tar Asphaltum + Gutta percha - U.G. not tough.

Linseed Oil boiled down until quite thick & then mixed with Gum Thus. —
— too brittle —.

Linseed Oil boiled til quite thick, then mixed with Gum Thus, together with Glue, disolved in Acetic Acid. — very soft.

Linseed Oil, Asphaltum & Calcined Magnesia mixed together — very tough.

Asphaltum & Litharge disolved together in Linseed Oil. — too soft & not tough.

+ Gum Thus & Copal disolved together in Tar quite tough but a little too soft. —

Gum Thus & Copal disolved together in Tar & mixed with Sulphur — very brittle.

Gum Thus & Gum Damar disolved together, in Tar. — too brittle

Sept 8 1883

Asphaltum. Gum Copal &
Cotton seed Oil - tough but
not Elastic enough

Asphaltum Oxydized Tar, Aniline
Oil & Gum Copal - tough but
not Elastic Enough.

Ditto with flour. Kneaded
in - brittle but tough.

EDKellogg.

Gum Thus disolved in, Linseed Oil boiled down until quite thick — too brittle and not tough.

Gum Copal disolved in Oxydized Tar & Aniline Oil. — plyable but not tough.

Gum Thus & Gum Copal disolved together in Tar & Aniline Oil — brittle.

Gum Copal disolved in tar & then put under pressure — crumbles up.

Gum Thus & Gum Sandarch dissolved together in Candle Tar — very brittle.
Gum Thus & Sandarch dissolved together in Candle Tar and Linseed Oil. — too soft.
ditto, ditto, ditto, + Sulphur — to brittle.
Sandarch dissolved in Candle Tar and Castor Oil — too soft and very sticky.
Gum Thus & Sandarch mixed with Castor Oil — brittle.
ditto, ditto, ditto, + Refined Asphaltum — too soft and sticky.
Hemlock Gum & Thus with Candle Tar and Castor Oil. — too soft and sticky.
ditto, ditto, ditto + Calcined Magnesia — too soft and a little sticky.
Dextrine won't mix with Oil.

E. D. Kellogg. Sept 10 1883

Resin & Candle Tar — Brittle Ote

" " " & Camline Oil — Brittle

Candle Tar & Red Lead — Tough but not elastic.

Candle Tar & Asphaltum — Tough but not Elastic.

Candle Tar & Kreuzie's Comp. — Brittle

Candle Tar Asphaltum & Cotton-seed Oil — not Tough nor Elastic enough

Candle Tar Asphaltum Cotton seed Oil & Sulphur — Brittle

Candle Tar Asphaltum & Hemlock gum — Tough but Brittle.

Candle Tar Asphaltum Hemlock gum & Sulphur — Brittle

Candle Tar, Resin & Asphaltum — not Tough nor Elastic enough

Candle Tar Resin Asphaltum & Sulphur — very Brittle

Candle Tar, Resin & Hemlock gum — N. G. too soft

Candle Tar, Resin Hemlock gum & Sulphur — Brittle

E. D. K.

Hamilton. Sept. 11." 1880

Gum Sandarch & Oil Juniper Wood - brittle
" " & Balsam Peru - not tough
" " & Oil White Pine - brittle
" " & Oil Orange - too "
" " & " Anise - too sticky.
" " & " Wormseed - too brittle.
" " & " Lemongrass - " "
" " & " Citronella - not elastic
" " & " Cubebs - too brittle.
" " & " Tansy - " "
" " & " Lemon - " ".

Gum Thus & Copal dissolved together in Candle Tar — too brittle.

Gum Thus & Copal dissolved together in Candle Tar & Castor Oil — tough but not very elastic

Gum Thus & Copal dissolved in Castor Oil. — rather elastic but too sticky.

Gum Thus & Copal dissolved in Castor Oil & Copal Varnish — a little too sticky. but quite elastic. — [illegible]

EDKellogg Sept. 11 1883.

Gums Thus + Copal + Oil Cubebs - little too Brittle

Gums Thus + Copal + Cotton seed Oil - Rather Brittle

Ditto + Sulphur - Brittle

Resin Gum Copal + Mirbane Oil - Brittle

Ditto + Sulphur - Very Brittle

Candle Tar Gum Copal + Resin - N.G.

Ditto + Sulphur Brittle

Candle Tar + Refined Asphaltum - Tough but not elastic

Ditto with Gum Copal - Brittle

Candle Tar Gum Thus + Asphaltum - Brittle

Ditto + Copal Gum - Very Brittle

Gum Thus & Copal disolved together in Asphaltum & Cottonseed Oil. – not elastic.
ditto ditto ditto + Turpentine – sticky.
Gum Thus + Copal disolved in Cottonseed Oil & mixed with small portion of Gutta Percha disolved in Turpentine. – tough but not elastic.
ditto, ditto, ditto, + Sulphur – brittle.
Asphaltum, Resin & Copal gum disolved together in Cottonseed & Linseed Oil. – not elastic enough.
Gum Thus & Copal disolved in Coal Tar & Cottonseed Oil. – Tough but not very elastic.
ditto, ditto, ditto + Copal Varnish. – brittle.
Gum Thus & Copal disolved in Coal Tar. quite elastic & not very sticky.

Resin Thus Candle Tar Copal & Aniline Oil - good but too sticky.

Gums Thus & Copal Resin & Aniline Oil - good but too Sticky

Ditto & Sulphur - Brittle

Gum Copal & Resin in Aniline Oil - Elastic but ~~sticky~~

Ditto Ditto & Sulphur - very Brittle

Asphaltum & Gum Copal in Aniline Oil - N. G. not tough or Elastic

Ditto with little Thus - elastic but Sticky

//

E. D. Kellogg Sept 13 1886

Asphaltum Copal gum & Gum Thus in Cotton seed Oil - No Good

Resin Copalzum & Thus in Aniline Oil - Very Elastic but sticky

do. do. do. do. with Sulphur - too Brittle

Resin Gums Copal & Thus in Myrbane Oil - Elastic & Tough but sticky.

do. do. do. do. & Sulphur - Tough & Elastic but too sticky

Resin Copal & Thus in Oil Tar - Brittle

do-do-do in Cotton seed Oil - not tough or elastic

do do do do do & Sulphur - Brittle

Resin Copal & Thus in Paraffine ~~Oil~~ - No Good

Resin & Thus in Oil Myrbane Brittle

do. do. do. do. do. ~~and~~. Asphaltum & Copal - Fair elastic but sticky

Gum Thus + Copal mixed in Coal Tar + Castor Oil. — not very sticky + quite elastic.

Gum Thus, Copal, Coal Tar + Linseed Oil. — rather elastic but too sticky.

Gum Thus + Copal mixed in Coal Tar + Aniline Oil — elastic but sticky.

Gum Thus + Copal mixed in Coal Tar + Oil Myrbane — elastic but a little sticky.

Gum Thus + Copal mixed in Palm Oil + Coal Tar. — elastic but still a little sticky.

Gum Thus + Copal mixed in Coal Tar + Oil Cade. — elastic but yet a little sticky.

Gum Thus + Copal mixed in Coal Tar + Paraffine Oil — elastic and a little sticky.

Gum Thus, Copal, Hemlock Gum + Tar — elastic and sticky.

Gum Thus, Copal, Hemlock Gum + Tar + Castor Oil — elastic + sticky.

Gum Thus, Resin + Copal mixed in Coal Tar + Castor Oil. — too brittle.

Gum Thus + Copal disolved in Coal Tar and
Origanum Oil. — elastic but sticky
ditto, ditto, ditto + Sulphur — brittle.
Gum Thus + Copal disolved in Coal Tar &
Oil Spruce — elastic but a little sticky
ditto, ditto, ditto, + Sulphur — brittle.
Gum Thus + Copal disolved in Coal Tar +
Oil Succini — very elastic but sticky
ditto, ditto, ditto, + Sulphur — brittle.
Gum. Thus + Copal disolved in Coal Tar &
Crude Oil. — elastic but quite sticky.
ditto, ditto, ditto, + Sulphur. — brittle

Sizes of stock for making
Clamps for 100. C.P. lamps

$\frac{9}{1000}$ thick $\frac{72}{1000}$ wide

H. de C. Hamilton March 7, 85.

Bleaching by Electricity.

Soaked material in salt water + passed it over two brass rollers, put on the dynamo current with resistance in circuit, + found that chlorine combined with the brass, leaving a green deposit on the muslin.

H. de C. H. March 10. 85.

Now by carbon rollers, chlorine given off + no deposit, but it doesn't seem to bleach, only to dry the muslin.

A. del. Hamilton April 20. 85.

Condenser Experiment.

Dipped thin sheets tissue paper in boiled linseed oil & then hung up to dry, to use for insulation.

Caromel wrapping Paper.

Dipped tissue paper in solution of linseed oil + Turpentine ½+½, also Linseed + Benzine, + linseed + Kerosene;

May 5th 85.

Colored the solutions with different aniline colors, dragons blood + gamlooge; + perfumed it with oil anise, oil Cloves, Sassafras, White Thyme + lemongrass.

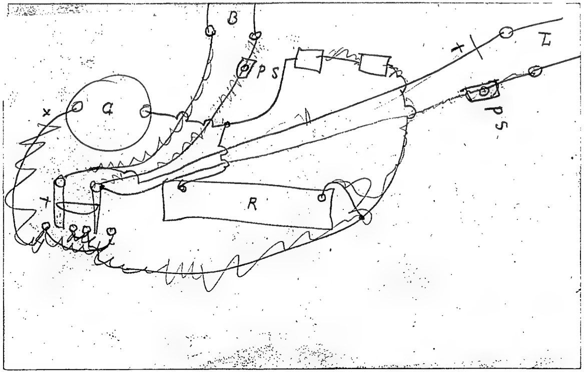
A. E. Hamilton

May 21st 85.

Storage Battery. —

Saturated soft thin paper in a solution of $ZnSO_4$ + $MnSO_4$ & laid them between sheets of tin foil as the insulations in a condenser & charged it with two carbon cells.

[ITEM FOUND IN BOOK]



[ITEM FOUND IN BOOK]

$$\begin{array}{r} 6470 \\ 9894 \\ \hline 16{,}364 \end{array}$$

Menlo Park Notebook #151 [N-80-06-01] (NOT FILMED)

This notebook was kept in 1880 by William Carman to record fibers received from John Segredor, who traveled in the South and Latin America to procure fibers for filament experiments. (See D-80-020, Document File Series.) The cover is labeled "From Segredor" and "John R Segr." The book contains 284 numbered pages. Approximately 10 percent of the pages have been used.

Menlo Park Notebook #152 [N-80-01-13]

This notebook covers the period November 1880-January 1881. Most of the entries are by Francis Jehl. A few entries appear to be by Francis Upton. Included are notes and calculations relating to tests of A-lamps. There is also a note and drawing by Edison regarding a method for preventing the carrying of carbon by electricity. At the end of the book is a list of the number of sons and daughters of Edison and others. The label on the front cover is marked "Reg Lamp A" and "Francis Jehl." The label also indicates that this notebook is, in part, a "continuation of Book No 138 at p 39." The book contains 284 numbered pages.

Blank pages not filmed: 22-29, 130-269, 272-277.

Reg no 1

One hour high vac spark gone
Previous 491. now. ~~49~~ 182
Put up at 5.30 Nov 20 1880
PM

Busted at about 3 AM Nov 28
1880

Reg 2

48 Candles for hour after spark went Res 170

Bast Plat clamps 5 hours Carbonization Extra high heat.

Put up at 2.30 PM Nov 19. 1880.

Reg No 3

Bake 5 hours Reg Vac Process
1 hour no spark. 191
Put up at 5.30. Nov 20 1880
Broke at Nov 28 - 10 am 1880
Carbon near the clamp

Reg no 4

Bast 5 hours Reg & Process

1 hour no spark 184.

Pups [illegible] at 5.30 nov 20 1550

Req. No 5

48 Candles for 1 hour after Spark R 191 Vict. Bast plat Clamp 5 hour Carbonization Extra high heat.

Put on at 2,30 Nov 19 1880

busted at Nov 28 10 am 1880

Carbon near the Clamp

Reg no 6

Bast 5 hour Reg process
1 hr no spark 202
10 X 1 X Bast $2\frac{17}{32}$ 508

Put up at 5,30 Nov 20 1880

Reg No 7 1880

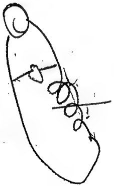
after hour spark gone 217
cold. originally 455 ohms

Put out at 5.30 Nov 20 1880

Put on at half past seven
Nov ~~28~~ ~~23~~ 22
103.30
119.2 ohms
4000 ft.
No 3

D | Up to Dec. 6. 6 PM. 164 hours
32
Burned at 3½ PM. Dec 8 1880 96 hours

2,46728
2,41821
2,41,872
$\overline{}$
6,418260
3,58174



Reg no 10

Page 77 book D
Present Reg Bart,

115 R
1525
4010 ft llm

7.30 now ~~20~~ ~~22~~ 22

14,2126
10
4,2126

1,343802
8,656198

3,753736 = a   a+b
4,952854 = b   a−b
a−b = a+(10−b)−10
a−b = a+10−b−10

10
4,952894
5,047106

Reg No 9

127.2 R
109. V.
4160 ft lbs.

7.30 nov ~~2~~ 22
busted at the
~~clock~~ 5 minutes
after putting out

$$\text{Ft lbs} = \frac{E^2}{R}$$

$$R = \frac{E^2}{\text{Ft lbs}} = \frac{E^2}{\frac{33000}{9.47}}$$

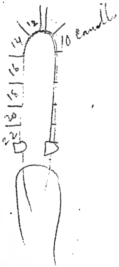
(Reg 11)

vacuum
Bamboo: very high ~~[illegible]~~
1 hour at high incan
descence. 9.47 per horse power
spark gone.

Put on at 4.30 nov 23 1880
at 16 Candles,,
I marked this Reg 11 but it is
not.

put up at 1 nov 24 at 48

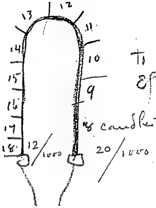
put up at 8 PM to 40 Candles
nov 23 Edison



12

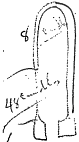
68
26
34
42
12)162(13½
12
42

Nov 28 1880 TAE



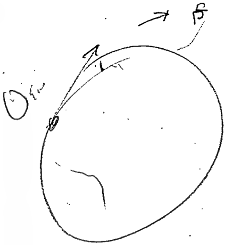
To prevent Electrical Carrying

8 candle incandescent



11

17
10
11
25
29
33
18
11)143(13
11
33



Nov 28 1880 TAE

Bamboo 10X17

Nov 30 1880 a.m.

3-53 Started very high globe entirely filled with blue very blue at clamps, with magnet

3-56 reversed

3-59 "

4-2 "

4-5 "

4-8 "

One of the clamps red blue very much less and none to be brought to the clamps by magnet. When current reversed the

heat left one clamp
from the other.

4-11 reversed
4-11-10 "

Intermittent

At varying intervals

Blue gone and the
carbon in both clamps
heated alike

4-15 busted
Went right above the
clamp

3ooa

305 151

308 170

310ª 150·

25127
4400

2) 39127
195·

311 180

2)25527
127·

315 157

317 162

324 162

337	158
338	177
339	160

340a	155
341	158
342	160
343	158
344	168
345	165
346	167
347	158
348	157
349	155

350^a	160
351	158
352	155
353	150
354	154
355	156
356	160
357	157
358	158
359	170

360a 166

361	158
362	165
~~366~~	
363	16.0
364	150
365	168
366	156
367	159 ~~[illegible]~~
368	168
369	159

370ª	160
371	158
372	163
373	164
374	158
375	161
376	353
377	165
378	156
379	163

380^a 200

381	168
382	160
383	150
384	152
385	155
386	158
387	155
388	148
389	159

390^a	155
391	154
392	no Vacuum
393	163
394	155
395	158
396	165
397	167 def
398	162
399	164

	400^a 155
401	154
402	155
403	161
404	153
405	162
406	159
407	154
407	~~156~~ 158
408	153
409	163

411	163
412	156
413	176
414	170
415	160
416	168
417	167
418	153
419	157

425 163

433	154
434	156
435	151
436	162
374	165
438	189
439	165

440 ∼ - 160

441	166
442	158
443	165
444	158
445	158
446	165
447	162
448	153
449	157

450 a – 160

451	162
452	167
453	158
455	159
454	175
456	162
457	161
458	150
459	158

460 ~ — 163

461	155
462	162
463	165
464	161
465	162
466	190
467	160
468	160
469	162

470a	164
471	165
472	165
473	154
474	155
475	no vacuum
476	157
477	155
478	155
479	164

480a	168
481	155
482	156
483	155
484	165
485	165
486	155
487	160
489	170
488	165

490^a 190

491	160
492	161
493	158
494	152
495	159
496	154
497	153
498	154
499	170

500	157
501	158
502	159
503	15[illegible]
504	160
505	163
506	156
507	165
508	159
509	154
510	145
511	160

511 160

160

Went up in Phone room 30 B

31	78
32	84
33	86
34	84
35	88
36	79
37	82
38	81
39	82

40 [illegible] 80

41	85 ✓
42	383
43	80
44	82
45	82
46	88
47	81
48	80
49	86 ✓

$50^{B} = 82$

51	80
52	81
53	80
54	86 ✓
55	85 ✓
56	88
58	82

70 B

512	160
523	– 169
527	160

532	153
533	153
535	162
536	163

550 A

559 182.

562	166
563	165
567	167
569	-163

5

572	168
573	166 —
574	164
575	163
576	160
577	168
579	165

581 Went up in Phon. room

582 155

583 167

586 143

587 163

589 168.

593	162
595	163.

11/30/80
Bast) 285) | Def 155 at 16 C

11/30/80
Bast 375 150 at 16

Bast 289 155 at 16

Bast 266 152 at 16

Bast 348 148 at 16

Bast 375 153. at 16

Bast 300 166 at 16

Lamp Jan 18 '8
Lamp from Upton to be run
down again. for meals

1 102.6 V 98.5 n.v

2nd 104.6 volts 101. n.v

5 101.25 volts 94.5 n.v

92 — n.v

7 97.87

93.5 n.v

8 97.87

N. 102.60 n.v

1/2 lamp. Jan 13 1880

Jehl

No 1 163
47.93 v

2 .164
47.93 volts

3 165
47.98 volts

4. 166.
52.65 volts

5/1 167
50.62 volts

6. 168
51.3 volts

7 169
48.60

8 170
52.65 volts

9. 171
56.7 volts

10 172
57.30 volts

11 173
50.6 volts

12 174
47.25 volts

13 180
50.60 volts

14 179
51.30 volts

 no v

15 178

53.32 volts

16 177

53.32 volts

17 176

47.25 volts

18 175

47.93 volts

52.65 volts

23 185

49.27 volts

no

22 184

47.93 volts

21 183.

47.93 volts

20 182.

54. volts

19 181

57.97 volts

29 187.

49.95 volts

28. 189

47.98 volts

27. 189.

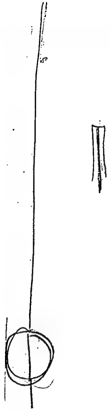
47.93 voltó

26 190

57.00

25 191.

52.65 voltó



J 7

38 1 105

1 2
2 3.
3 4

22 23 94

1000
105
895

1000
94
906

1000
320
680

wws 320680

$\frac{680}{320}\ \frac{x}{.0187}$

680 X.0147 = 3

895 : 105 : x :: .0187

~~906 : 94 :: x~~

906 : 94 :: x : .0187

680 : 320 :: x : .0187

895 1
.0187
6265
7160
895
105 | 16.7365 | .1593
105
623
525
986
945
415
315
100
105

906 2
.0187
6342
7248
906
94 | 16.9422 | .1802
94
754
752
222
188
34
94

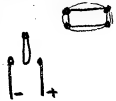
3

680
.0187
4760
5440
680
320 | 12.7160 | .03971
960
3116
2880
2360
2240
120
320

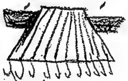
.1594
.0397
.1197

.1802
.0397
.1405

test of coal oil Lamp
at 48 candles ~~of the~~
to show that we can
test a coal oil Lamp
at 48 candles



	Daughters	Sons
Gen. Palmer	2	⊗
W.H. Painter	2	⊗
Dr Wm A. Bell	2	⊗
Chas Batchelor	2	⊗
S. Bergmann	2	⊗
E.H. Johnson	2	⊗
T. A. Edison	1	~~2~~ 2
R. R. Upton	1	0
J.C. Reiff	2	2



Reg 427 - 9.6 velot
Quall 8.38

	Boys	Girls
T. A. Edison	2	1
Chas Batchelor	0	2
F. R. Upton	0	1
~~Mr~~ Moses	1	2
J. L. Griffin	1	1
Mr Kruesi	3	0
Mr Dean	1	0
E.H. Johnson	0	2
Mc Kenzie	18	9+4

22) 100 (.45
88
120
110

Menlo Park Notebook #153 [N-80-09-11]

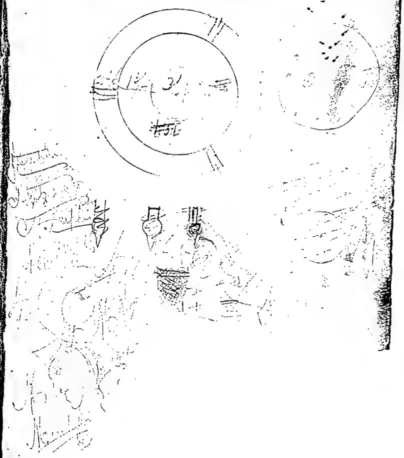
This notebook covers the period September 1880-February 1881. Most of the entries are by Edward H. Johnson and John Ott. There are also a few entries by Edison and Charles Batchelor. Most of the material relates to experiments by Johnson, aided by Ott, to develop fixtures for use by consumers of the electric light. Included are notes, drawings, and instructions regarding the design of chandeliers, sockets, and interior wiring. There are also notes and drawings by Ott relating to experiments on an electric meter; drawings by Edison of the electric railroad; and drawings and notes by Batchelor on copperplating carbons in order to clamp them to lead-in wires. The cover is labeled "J. F. Ott. Meter" and "Socket." The book contains 282 numbered pages.

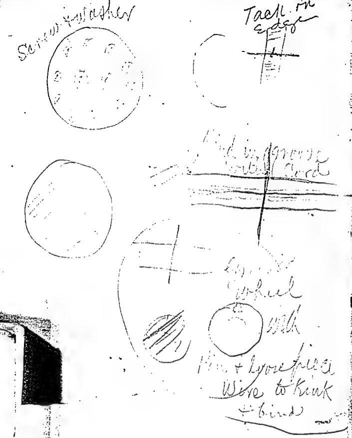
Blank pages not filmed: 134-139, 198-274, 277-278, 281.

Missing page numbers: 35-36, 275-276, 279-280.

Memphis

~~No.~~ Chandeliers

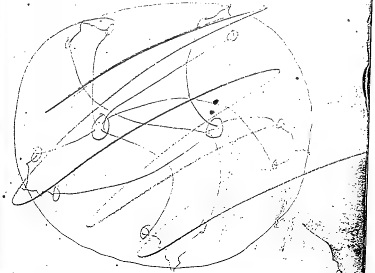


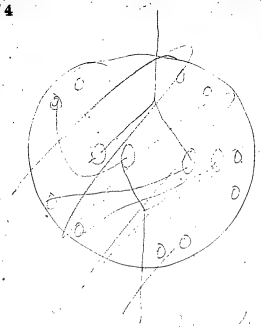


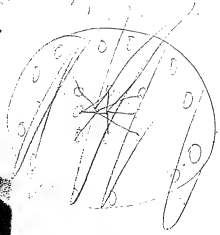
~~Eugene Phillips~~
~~1 ft [illegible] Wire~~
~~Ever made or [illegible]~~
~~Sept 11/80~~

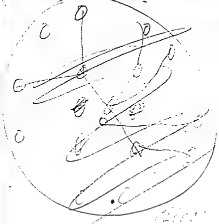
Done

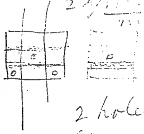
~~1 [illegible]~~
~~[illegible]~~
~~[illegible]~~











[illegible] + [illegible]

2 holes + tie to
gas Pipe

use Rubber Rings + [illegible]
this block [illegible]
wires taut — or Spiral Springs

If 2 wires are [illegible]
together — Rubber bands
will hold them without
Block —

Cover wires with
Strip brass wound Spiral

Brass Wire Spring slipped
Over wires [illegible]
Grounding where wires
are thin and flexible

thin brass stamping
Spiral [illegible] thus,

Ω or this,

[illegible]

Vulcanite tubing N.Y.
Will work with heat
of burner

Wants

Spiral Springs for Wire [illegible]

See Mitchell Vance man
about Shaping machines
for Ornamental work

to Keep Dust & moisture
Off Connection at top
of Chandelier — slip a
Rubber Coat over Block
overlapping its Edges
& filling [illegible]
[illegible]

To make — John Ott —
Insulating Block —
3 Lamp Sockets — [illegible]
Wind Over Brass wire
Spirals

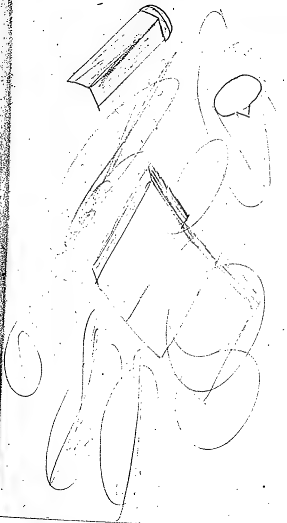
adopted -
3 Tacks in line - for a
Wire fastening . Thus

Wall Brackets

Special Wall Cap for Connections

Bear the Bracket [illegible] with
Spirally wound wire to give
flexibility

~~W~~ For [illegible]
use Spiral Wire & wind the
Conductors Spirally

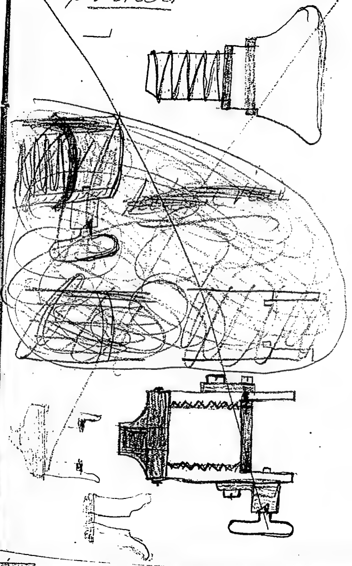


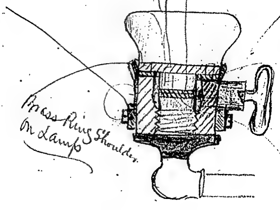
Hall Lights

To raise & lower –

use Spirally woundwire. –
& Wind Conductors in the
Spirally

Sockets



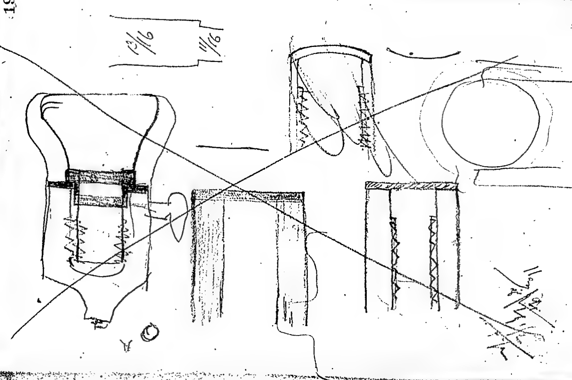


Brass Ring Shoulder
On Lamp

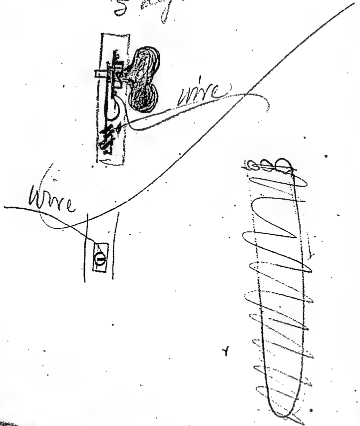
Boss Socket

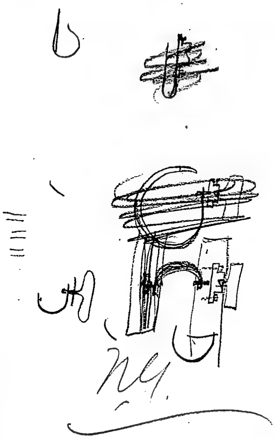
Flat
Brass Ring on top
of Socket

thin brass wrapped around
Lamp holder



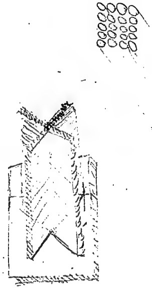
Edison says N.Y.



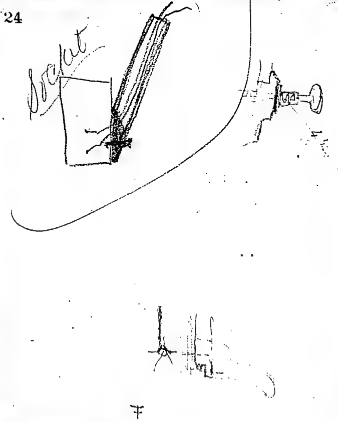


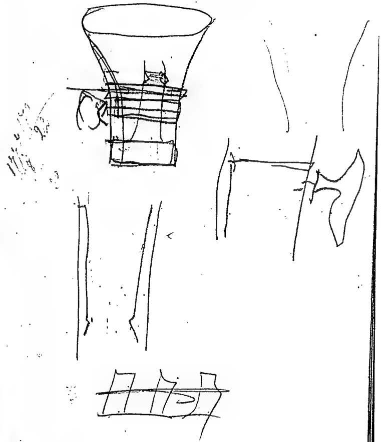
ask Edison if Metal
Can be covered
with thin Vulcanite

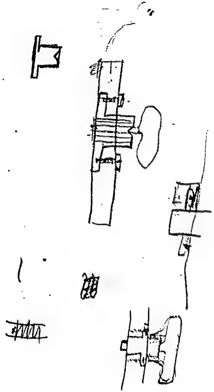
If so cover the cock
of Lamp Socket

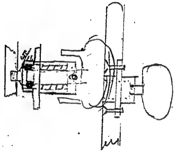


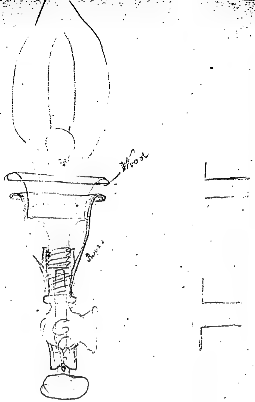
16 wires of 34 1/2
0.1 Diameter

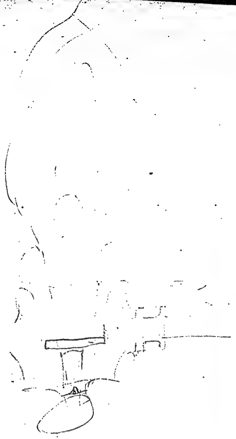

Socket

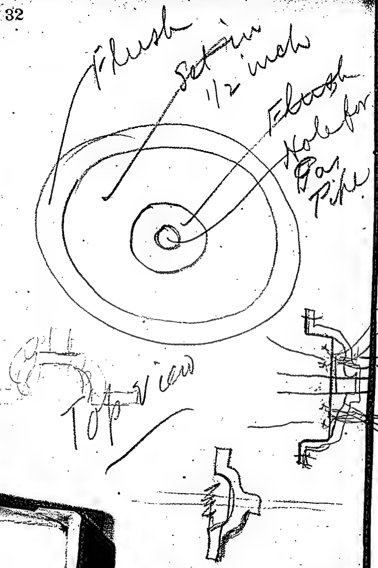


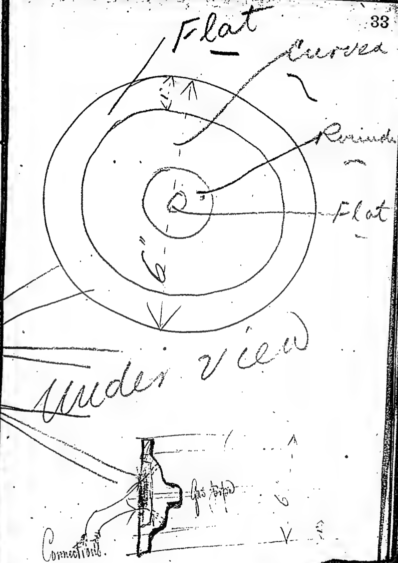


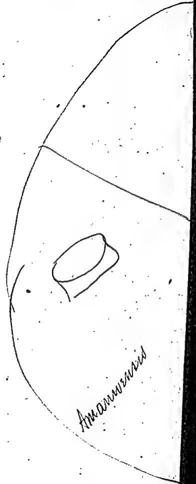



Wood
Brass




Flush
Set in 1/2 inch
Flush
Hole for Gas Pipe
Top view

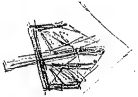

Flat
Curved
Round
Flat
6"
Under view
Gas Pipe
6
Connections



Make Large Socket with
Wood Screw - Flat thread

More curve at top - 

3/8 in Tit on Glass for Cork



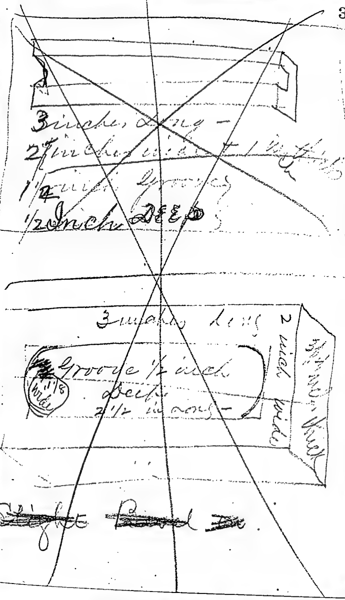
Wires

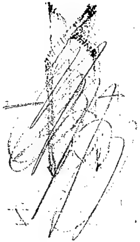
25/1000 wire copper

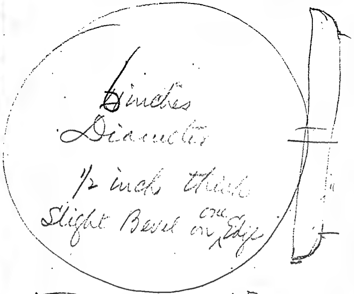
75/1000 Insulation

1/32 in Lead Sept 23/80

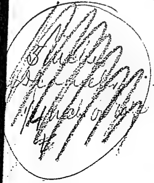
m



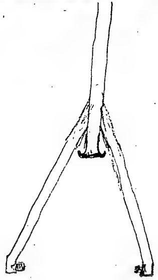


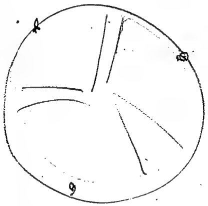


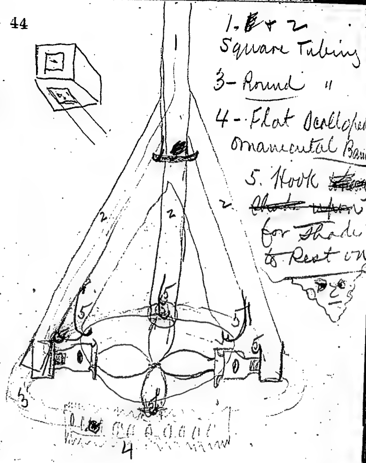
~~6~~ inches
Diameter
1/2 inch thick
Slight Bevel on one Edge



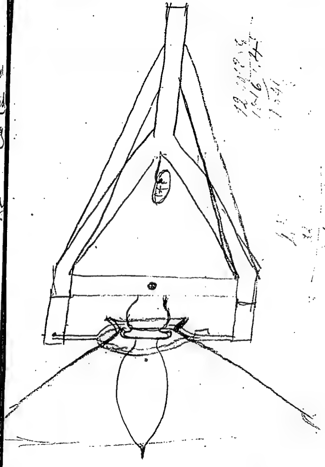
5 inches outside
4 inches
1/2 in Deep

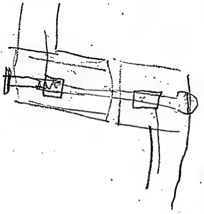


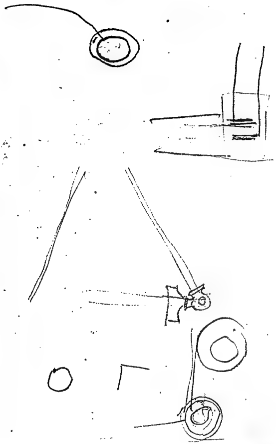


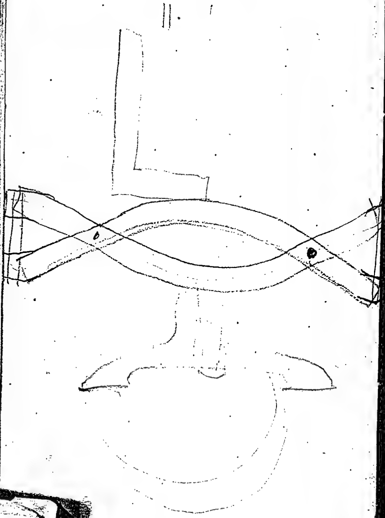


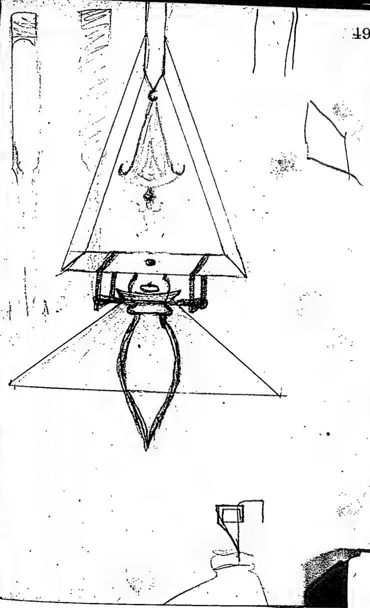
1. ~~B~~ & 2 Square Tubing
3- Round "
4- Flat Scalloped Ornamental Band
5. Hook ~~Ring~~ ~~Chain upon~~ for Shade to Rest on

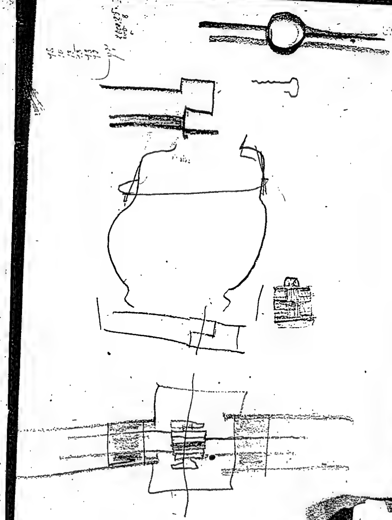




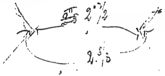




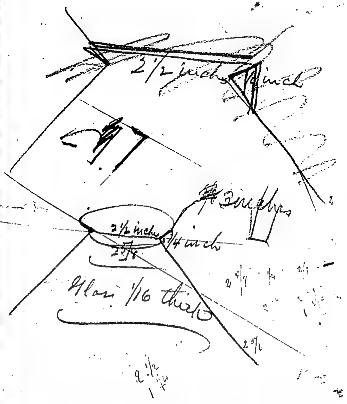


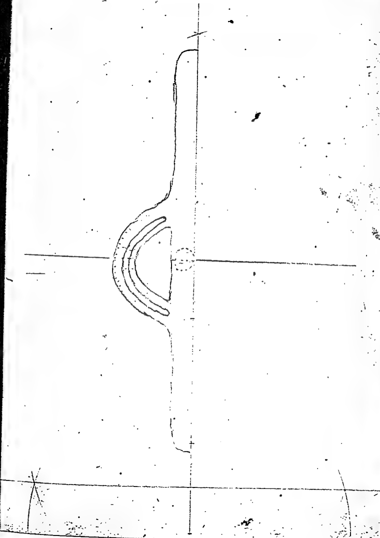


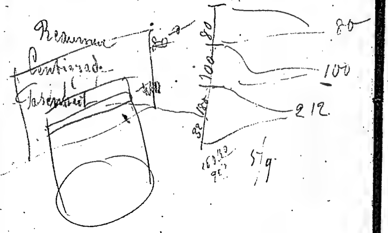
2. 3/32

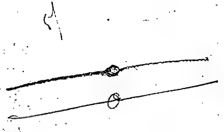

2 1/2
2 5/8

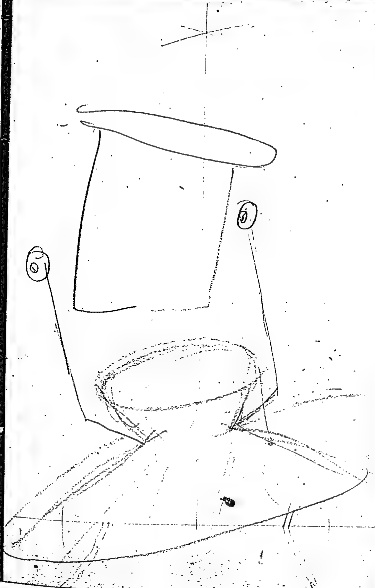
13

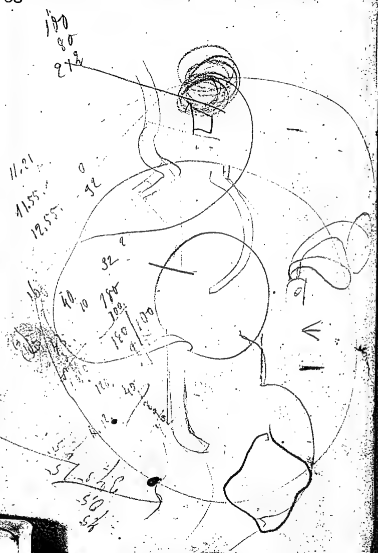

2 1/2 inch
1/2 inch
3 inches
2 1/2 inches
1/4 inch
2 5/8
Glass 1/16 thick
2 5/8

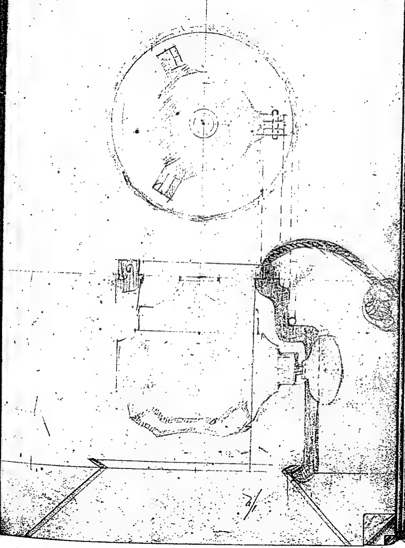


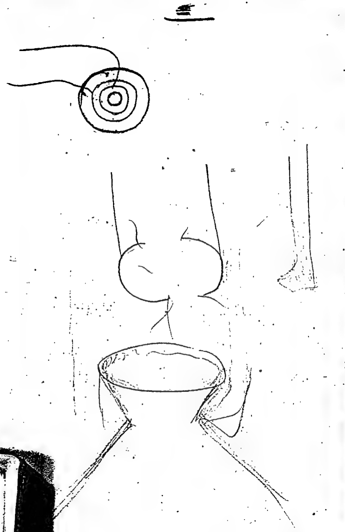

80
100
212

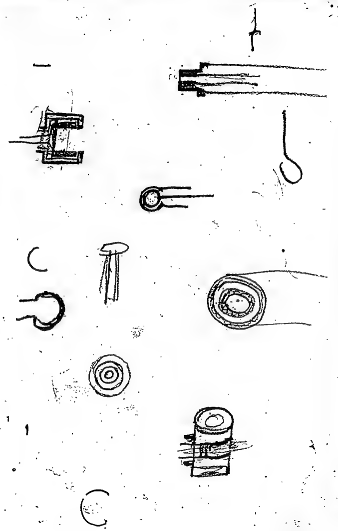




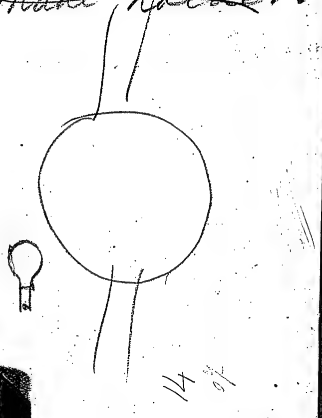

100
80
11.21
11.55
12.55

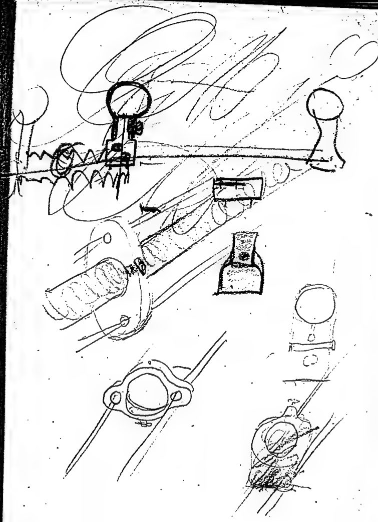


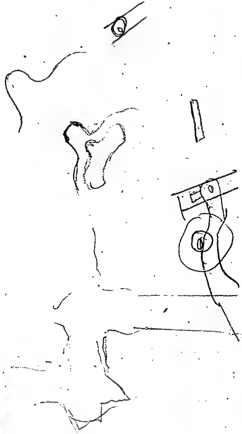


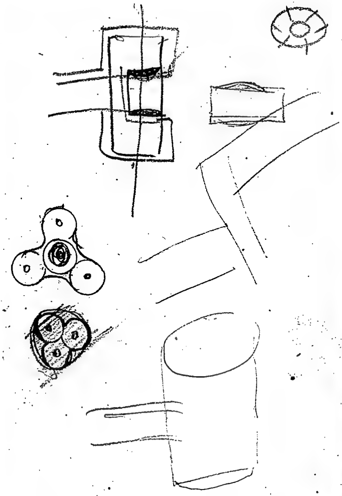


~~Go ahead on Shade Ladder.~~









2000

20
4
80

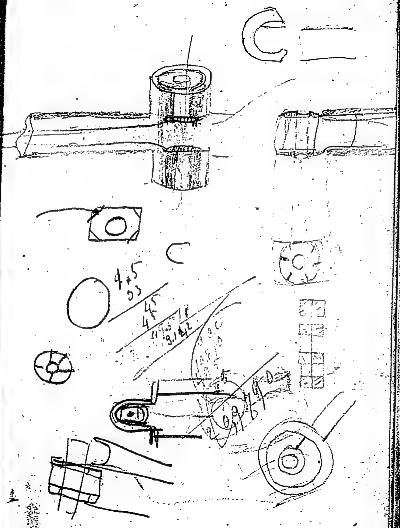
159

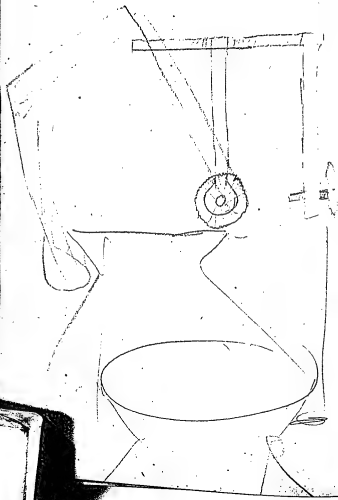
15
10

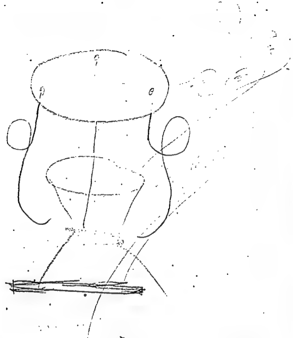
510

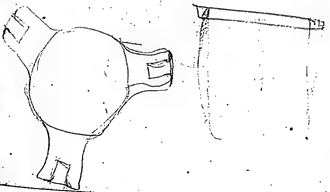
51

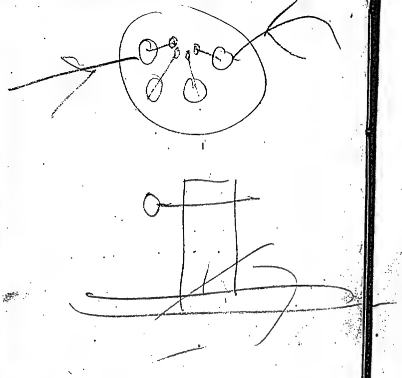
405

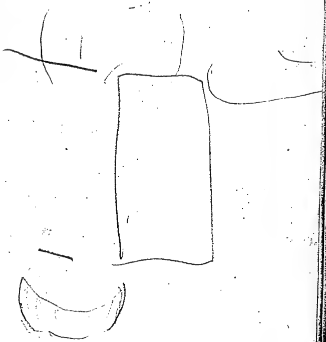


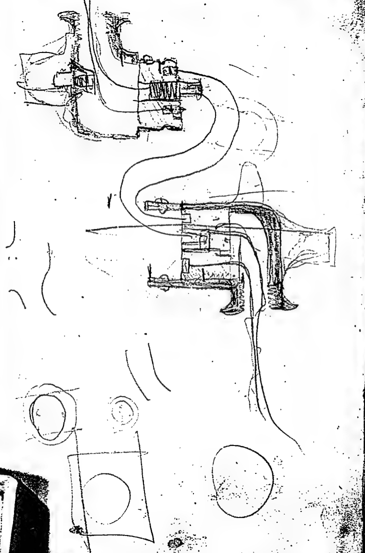


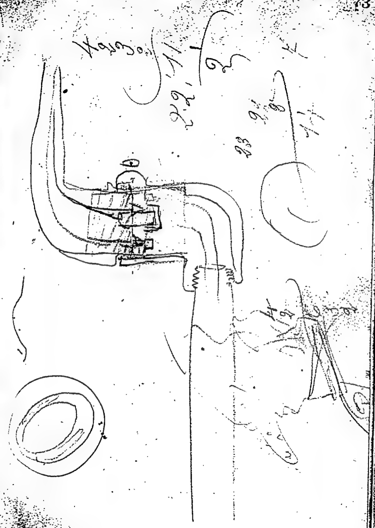


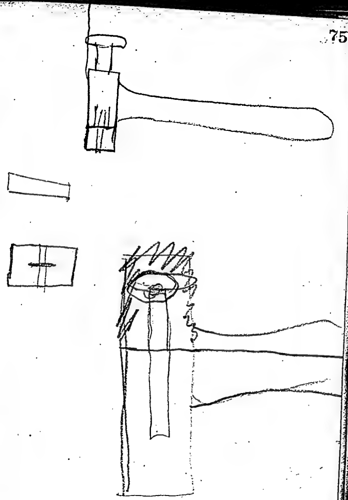


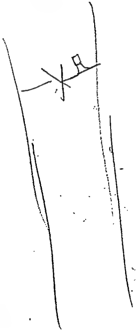


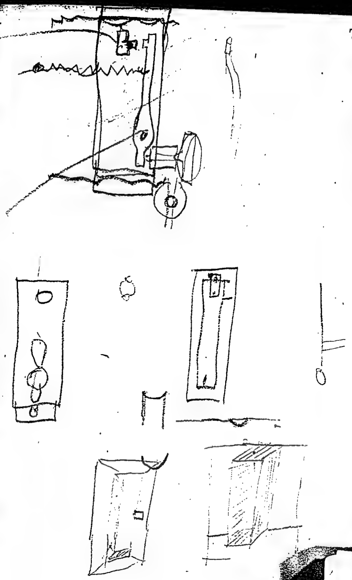


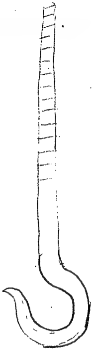


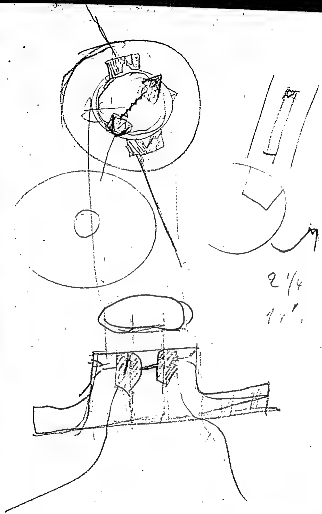


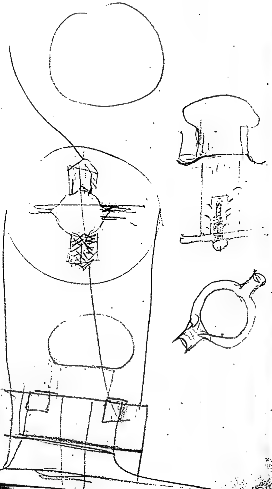


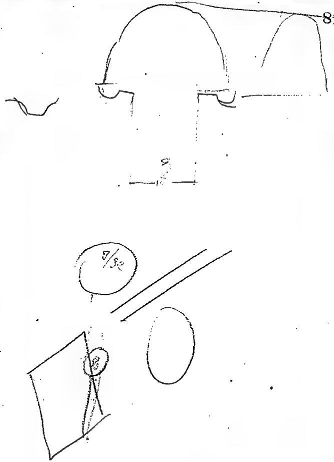


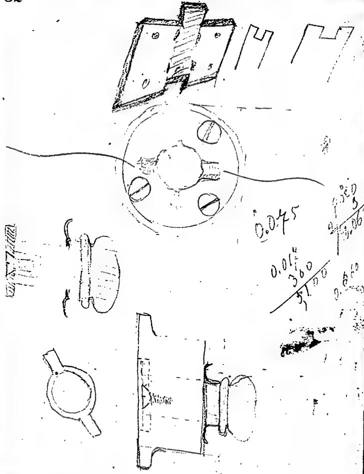





2 1/4




3/32

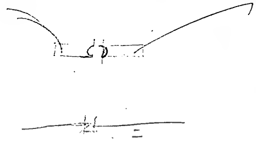


0.075

0.060

0.014
360
5.100

like any Plaster
with Glue [illegible]
& Cement [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] by Ch[illegible]

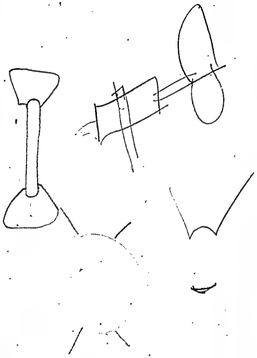


For this [illegible]
Switch same
as the other
— make [illegible]
holes [illegible]
for the [illegible]

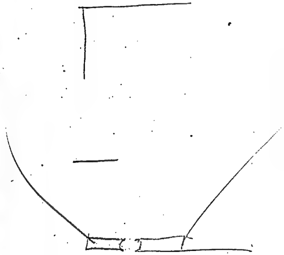
and

cut the wire [illegible]
where marked
with Pencil

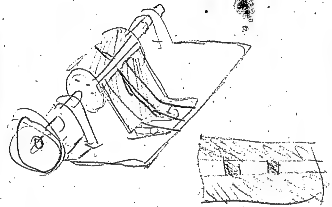
[illegible]



Make this



12 Nov 1880 Toh



T	C	T	C	T	C

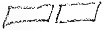
9	C	9	C

Johji —

Please solder
these two cords
together neatly
so as to make
one long cord
Keep them straight

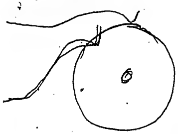
E.H.

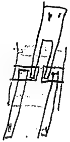
The short spring
wont do — The Ends
of the springs must
be exactly on top
of the cylinder —

The copper strips
must be split
in the centre.
thus: 

E.H. Johnson

over



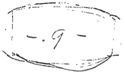


When you finish
this job go on
with the Lamp
Sockets GHJ

14
4
56

52

4 12



18

14
56

75.8
75
14

195
12
390
195
2340
37
16380
7020
86580 = 721.5

35
8
280
42
40
362

1185) 2323

4) 118.5

12) 86580
25

227) 721.5 = 328
681
415
1880

29.6
1.8

4.940
362
5.332

19.5
3
585

118.5) 8658.0
8295
3630
3550
4.2

40.0
78) 721.5

19.5
16

54
6
324

44
6
264
344

032
296
80
376

170) 721.5
680
415

86 single 6.1 No 20 wire = 6.1 ohm

1185) 721.5
7110
1050

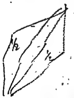
52
6
312

52
4
208
73
1040
1456
12) 15100 (1258
12
31
24
70
60
100
96
4

28

312
45
1560
2248
12) 23890 (2108
24
23
12
100
896
4

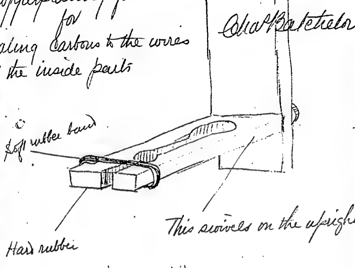
6 3⅜
12
72
3
75

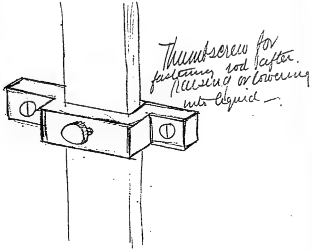


Copperplating pictures for plating Carbons to the wires of the inside parts

Dec 29th 1880

Chas Batchelor





14 2/2

14.2 × 2 × 3/16

.0625
.1875

4.70
4.70
9.40

14.5 × 2 ×
2
29.4
29.4
26.46
5.58.8

22
11

Cubic inch 220

9 4 0
4 7 0
14 1 0
12 / 120

5.6
.312
112
336
168
1.7472

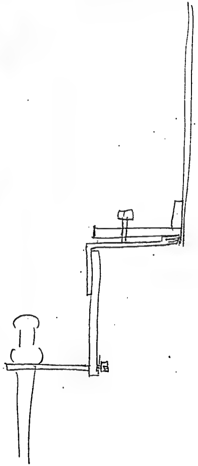
2.6

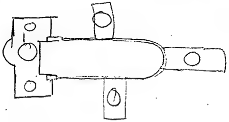
Cost of Resistance box as made by Bergman

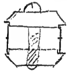
German Silver Wire

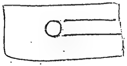
Base	20	.35
Wood for Spools		.20
Iron screws (Wood)	30	15
Brass wood screws	84	40
6 Brass screws for Bind post ~~Bind posts~~		12
Making Spools		1.50
6 Copper washers		4
Brass	2 lb at 23	46
Rubber for plugs	6 plugs	.10
Drilling	47 holes	.10
Reaming	34 holes	.10
finishing		1.00
Sawing		15
Making plugs	6	.30
Assembling		1.50
		6.50

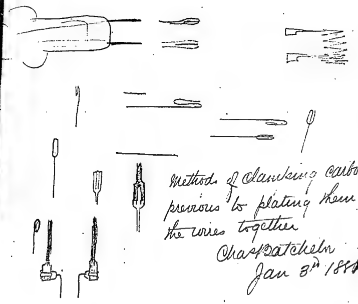
Gave Bergman Contract for 100 at $7 each







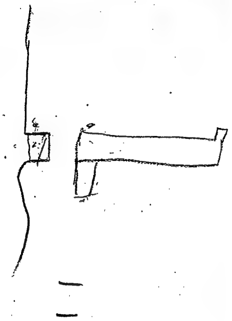


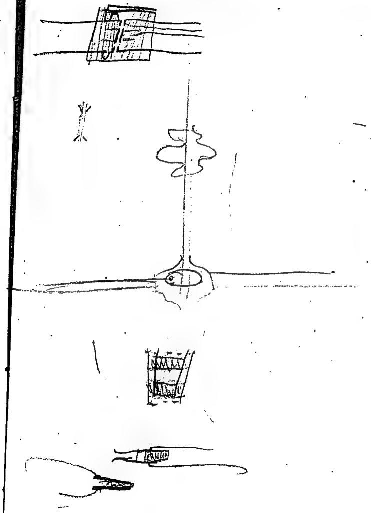


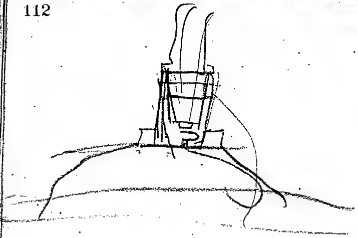
Method of clamping carbons previous to plating them and the wires together
Chas Batchelor
Jan 3rd 1880

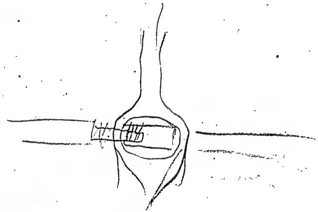
John

Please cut enough
off the lead strip
in the old "new"
socket to prevent
a short circuiting

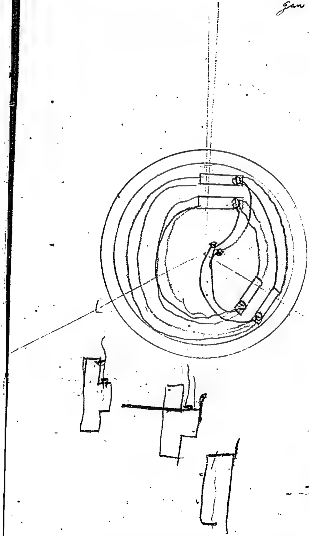


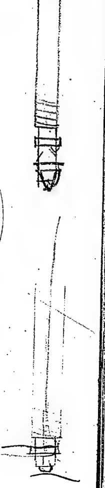






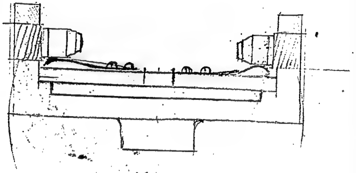
Jan 20, 1881
John F. Ott.

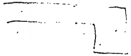


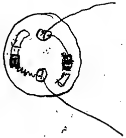


Jan 20. 1881

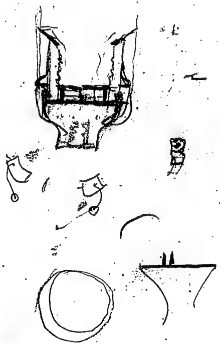
John F Ott

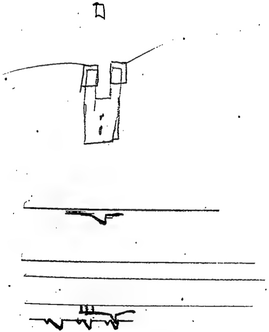




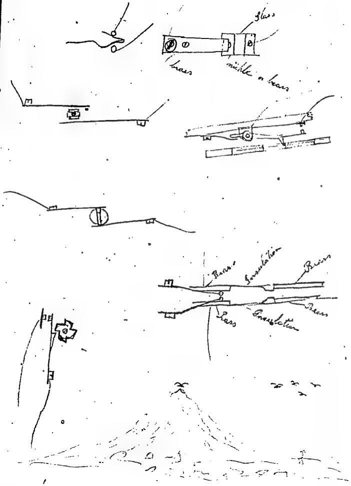


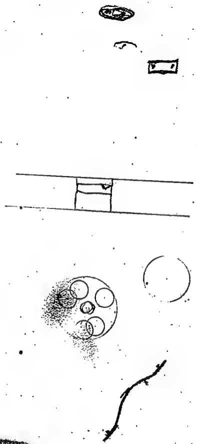
Jan 26. 1881





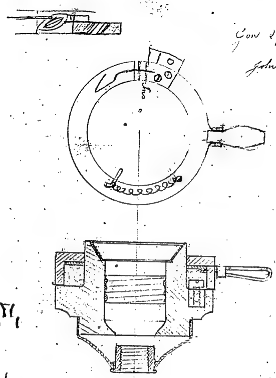
Jan 27, 1881
John F. Ott.

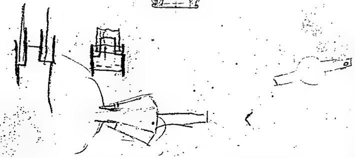


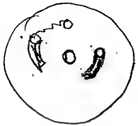


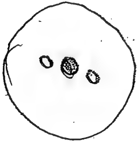
Nov 27 1881

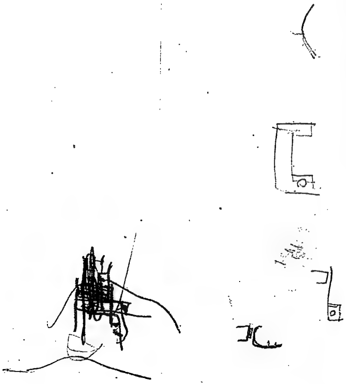
John F. Ott.



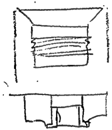


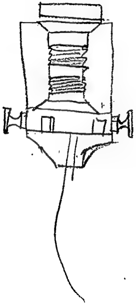


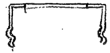


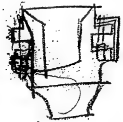


7.

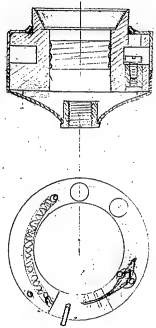


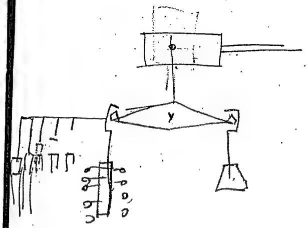






Jan 27, 1881
John F Ott

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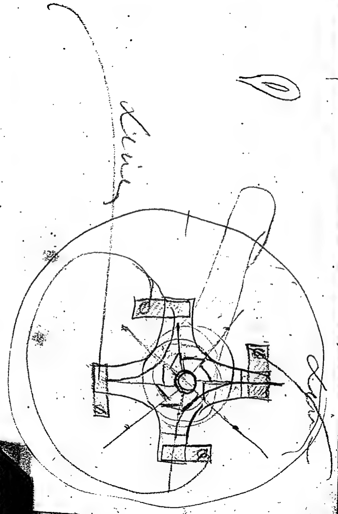
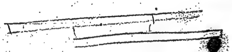
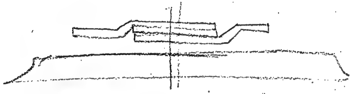
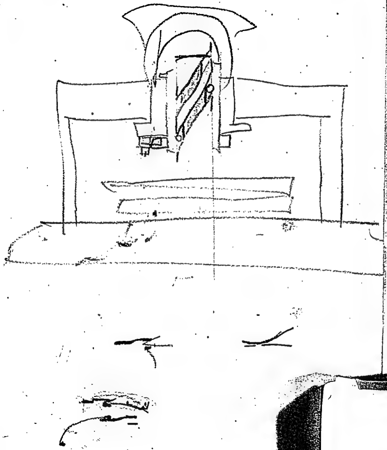
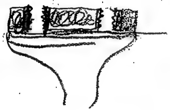
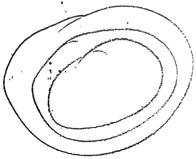


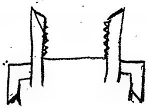


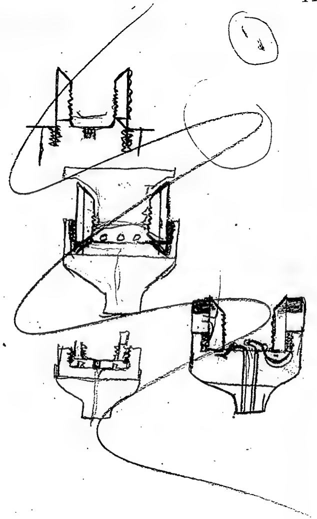










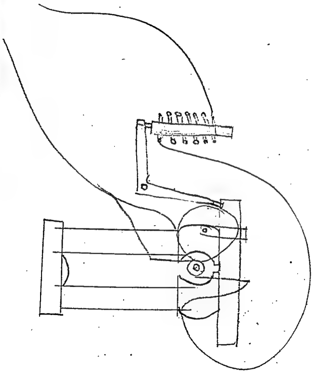


John please
Fix this One
to turn like
the Other and
Nurl the top
Cap.
E H J

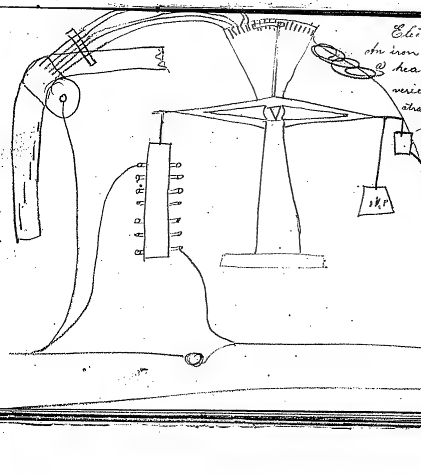
T. A. Edison

Feb 12, 1881

John F Ott



Electric Meator.
An iron core suspended in a healix, as the curent veries so will the magnetic atraction very tilting the beam up or down shunting the curent from one pen to the other on camical paper

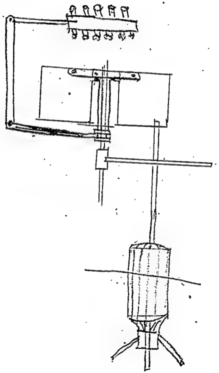


T. A. Edison
John F. Ott
Feb 12. 1881

Chas. Edison

John. F. Ott.

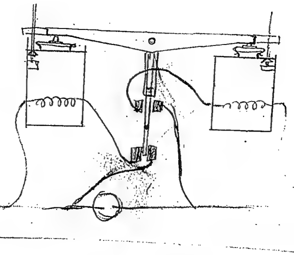
Feb 12, 1881.



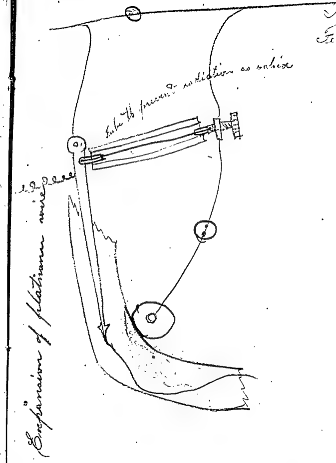
T. A. Edison John F. Ott.

Feb 12. 1881

Two air tights chambers, the curent being past through causing the air to expand acting on diafram that acts on leaver shunting the curent in the opiset one then vice virce.

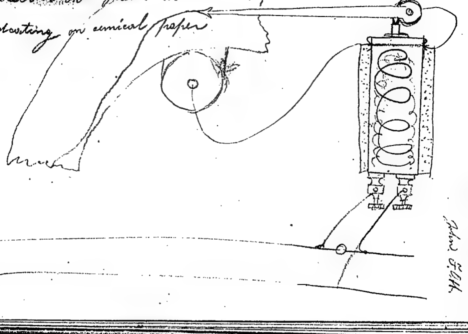


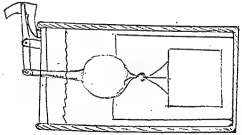
T A Edison
Feb 12, 1881
Jno F Ott



T. A. Edison
Feb 12. 1881.
John F. Ott.

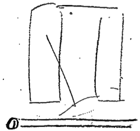
A spiral of wire inclosed in a airtight chamber and offering suffici[ent] resistance to heat when the ~~current~~ flows, and expanding the air ~~to act on~~ diafram which acts on leaver and indicating on cemical paper

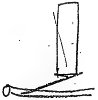




John Ott

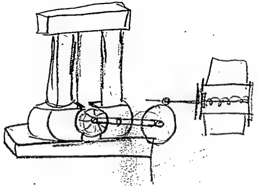
Please have the new wooden sockets which will probably come Monday — all fixed like this one — no cork wanted — use the thin German silver — & give plenty of surface contact — instead of great pressure — round the contact pieces a trifle before putting ~~the~~ the spring in — fasten it in with 3 pins from inside — make spring exactly size of this one — solder wire connection to Binding Post & make both B Posts alike — E.H.





Menlo Park Jan 12. 1881

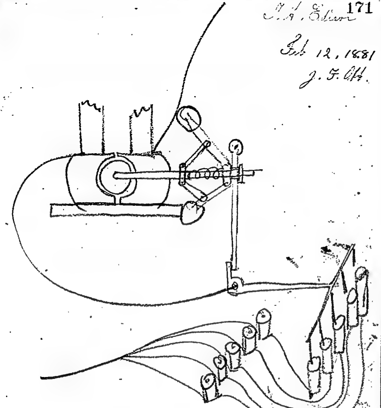
J. F. Ott



Speed regulator the fan so arranged as to open as the speed increases offering more resistance

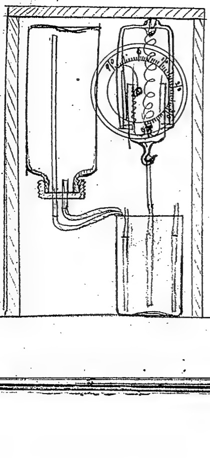
T. A. Edison

Feb 12, 1881
J. F. Ott.

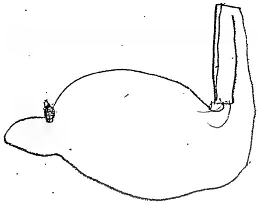


Speed regulator as the speed increases the governor opens and moves levers and throws ~~in~~ resistance

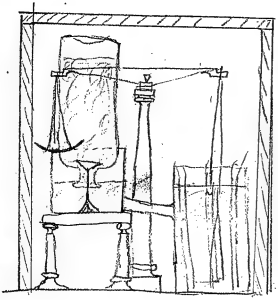
T. A. Edison
Jan 15. 1881.
J. F. Ott.



Automatic Solution feed, and spring scale indicating the deposit when one plate being to heavy they are to be revissed when the inspector inspects the Meter



T.A. Edison



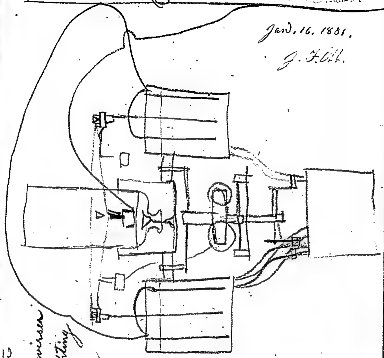
Automatic solution
fixed and beam scale
only to weigh when
the inspector inspects
The Meter

Jan 16, 1881.
J. F. Ott.

T.A. Edison

Jan'd. 16. 1881.

J. F. Ott.



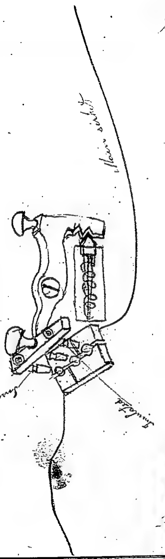
Alternate Heater
without current reverser
on every tilt emptying
the jar and filling
the first one

T. A. Edison

John F. Ott

Sep 1880

Note arc switch which can be shorted by hand or foot



Heater No 3

On Time	Weight	Off Time
9 20.	18.07	11.00
R 11:15.	13.20.	12.15.

8

16

6 5/8
8 1/8
14 6/8

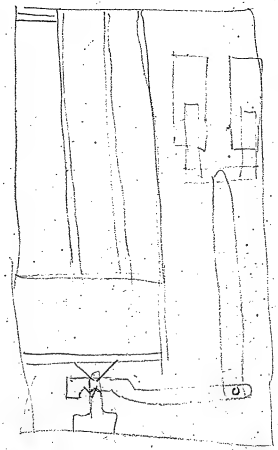
2 5/8
5 7/8
8 4/8

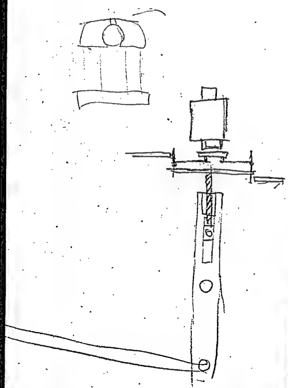
2 3/8

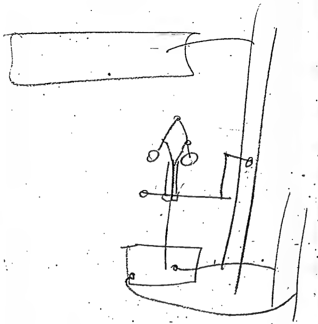
4 3/8
9
16 7/8

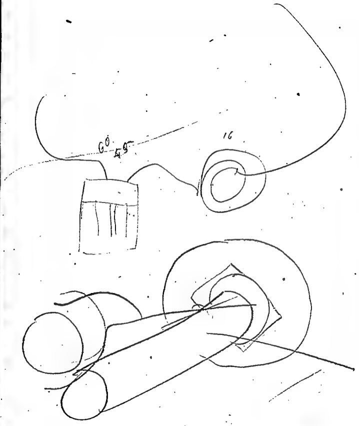
Meatta Falls 2

Date	Time	Feet	Date	Time	Feet			
Feb 18	315							





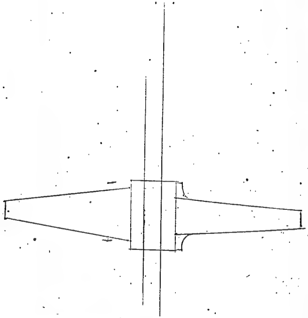


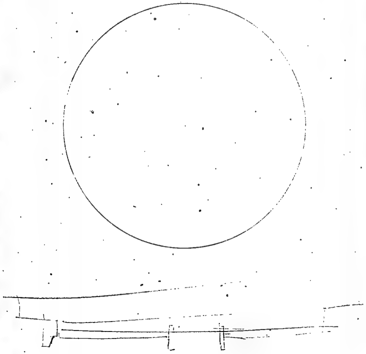

60
49
16

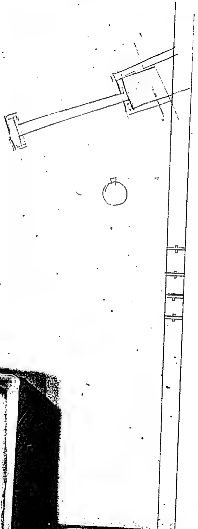
312
87
2184
2496
12) 26644 (2220 4/12
24
26
24
24
24
4 28

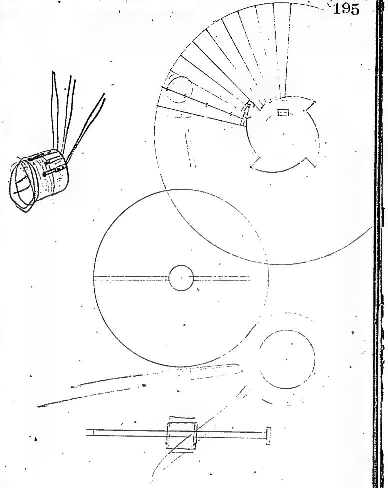
7 3/8

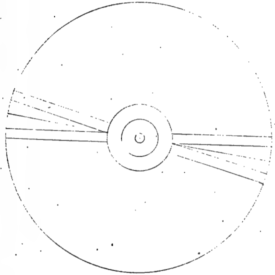
7 3/8
12
84
3
87











Pour réduire m/m en pouces ang.
ajoutez 0, & ÷ par 0.254

Pour réduire pouces en m/m
ajouter 0 & ÷ par 4.

Le resultat augmenté de
4/10 du nombre donné de pouces

6
4
24

1600 | 4
20 | 150
2.4
152.4

200000 | 0.254
= 32 | 1800

= d

2,54

4"

Menlo Park Notebook #157 [N-80-12-24.2]

This notebook covers the period December 1880. The entries are by Francis Jehl and Francis Upton and consist of notes and drawings relating to lamp tests. The label on the front cover is marked "Lamps" and "Francis Jehl." The book contains 284 numbered pages.

Blank pages not filmed: 24-25, 94-105, 108-177, 182-284.

No 521 a

185

370
123

R 18840
4300
48 C

13140
1157

2.0899
2.0899
1.6464
1.9375
3.7670
0.5155
.7845
6812
4357

5510

0.68

272 candles
per H.P.

34

68

21.6 : 129 :: 68 :

68
1032
774
21.6) 877 20 (402
872
520

201

182

R 18840
4150

C 48

364
121 Volts

22990.
184.9

.0838
0838
6464
9391
7531
5185
7654
6812
4466

5560

5.82

280 candles
per H.P.

126.6

8773
1106
1237
1316

135
13
+ 2 Ohms

190
18840
.7780
148

12659.0
132.95

1380
126.6 Volts

1026
[illegible]
[illegible]
8748
7264
5185
7921
6 8 [illegible]
4733

[illegible]
62
277

~~.9999~~

.9090
1106
0670
.0865

122
116.7
5.3 Ohms

185

1840
4500
@46

(23340
116.7

(370
1233

.0910
0910
6464
9330
7614
5155
7571
6812
4383

5770

5.72

274 candles
per H. P.

~~9330~~
9330
0200
953
1106
~~9966~~
70636

115.5
104.7
10.8 Ohms

513[a]

175[a]

350
116.6

18840
2100
20940
104.7

0670
0670
6464
9800
7594
5185
7591
6812
4.403

5740
5.74
2761. candles per H.P.

9208
0364
1106

0678

117
1087

8.3

524 A

180 = 0

1360
120

15840
2900
21740
1087

0792
0702
6464
9636
7684
5185
7501
6812
4313

5870

5.63

270 candles
per H.P.

520 A Retested Dec 27

8950
0966
1106
9022

126

+2

520 A Dec 24

48 C
191

1382
1273

18840
6150
24990
124.9

5
1050
6000
9034
7598
6785
2402
6812

5.13

4.199

269 candles per H.P.

8893
1045
1106
1044

127

5231 A

194

388
129

18840
6600
25440
127.2

1106
1106
6464
1955
7631

2369
5185
6812
4360

1997

273

9 3 0 5
0 6 7 1
1 1 0 6
1 0 8 2

1 2 8 3
1 1 6 1 7
1 1 . 6

5 14

176

1352
1 1 7 3

18640
4500
23340
116.7

0695
0695
9329
7145
2817
1997
4814

303

9066
0835
1106
1007

126
121.2
318

515 LA

186

48 candles

372
124

18840.
5400
24240

121.2

0934
0934
6464
9165
7497

2503
1997
4500

282

9151
0519
1106
0776

119.5
112.7
6.8

517 ~~4~~

18.2.5

1365
121.6

18840
3700
22540

112.7

~~9151~~
9849
0849
6464
9481
7643

2357
1997
4354

272 candles
per H.P.

9045
0632
1106
0783

119.6
115.7
4

522 ~~A~~
48 candles
187

374
124.6

18840
4300
23140

115.7

0955
0955
6464
9368
7742
2257
1997
4254

266 candles
per H.P.

9090
0942
1106

0538

183
1092

~~278~~
87.8

427 A

185

370
123.3

18840
2800

21640
108.20

0910

9600
1742

2058
1917

4055

254 candles
[illegible]

~~a Volt~~ 2 2555
amps 2.00 8 6970
amps 1.05 9.966

0,9221
836 = Deflection for 1 Volt

7143
9221
7922
7922
6464
2873
5181

59.2

33 ohms 5188
3822
8981

8987

candles per H.P.

B 5 9

935

~~12550~~

Retested

20 cells

90.5
94
160.5

258
260
518
6279
4050
10329
57.6 Ohms

7 2 6 1
9 2 2 1
8 0 3 0
8 0 3 0
6 4 6 4
2 3 8 8
4 9 1 2

5 0 8 8
8 9 6 7
4 0 7 5

63.5

1970
7612
8388
7970

61.2
57.7
+ 3.5

256 candles per H.P.

62 B

20 cells 90.5 L
94 R

265
271
536

6279
5.3 ohms
11579
57.7

261
265
526
536
1062
531

7657
9221
8436
8436
6464
2000
5336
4664
8987
3651

69.7 Volts

62.4.

1564
8000
8388
7952

+ 0

232 candles
1 per H.P.

66 B

24C

~~288~~
295
583

6279
6350.
12629
63.1

7235
9221
8014   63.3
8014
6464
2774
5266
4734
8987
3721

1986
7226
8388
7600
57.6
52.8
$+$ 4.8

236 candles per H.P.

65 B

24C
261
258
529

16279
4300
10579
52.8

7597
9221
8376
8376
6464
9884
5106
4900
8987
3887

64.8 Volts

+ O

245 candles
per H.P.

60 B

24 C

285
290
575

6279
6700
12979
64.8 ohms

7482

9221

~~6701~~

~~67~~03

~~6464~~

2069

1939

+0.

8261 68.5

8261

6464

2069

5055

4945

8987

3952

248 candles per H.P.

63B

24 C

278

282

560

6279

6150

12429

62.14

7419
9221
8198 6.6
8198
6464
1979 + 2
4839
5161
8987
4148
260 Candles for A.P.

64 B
24 Candles
.278
274
552
~~4884~~

6279
6420
12699
63.4

7813
9221
~~6734~~
~~673~~
8292 67.5
8292
6464
1938 + 1.5
4986
5014
8987
4001
251 - candles per H. P.

61 B

4 C

280
284
564

6279
6530
12809
64"

7528
9221
8307
8307
6484
2125
5263
4797
8987
3784

67.7

+1.2

239 candles per H.P.

57 B

24 candles

285
281
566

62.79
6000
12279
61.

7536
9221
8315 67.8
8315
6464
1798 ~~40~~
4892
5108
8987
4095
256 candles per H.P

35 B

24 candles

282
285
567

6279
6950
13229
66.1

7076
9221
7855
7855 61
6464
3002
5176
4924
8987
246 3911

31 B

24 candles

258
252
510

6279
3750
10029
50.1

7597
9221
8376
8316
6464
1978
5194
4806
8987
239 3793

68.8

46 B

24 candles

285
290
575

6279
6700
12979
64.9

7482
9221
8261 67
8261
6464
2211
5197 + 2
4803
8987
3790 239

44 13
24 Candles

277
283
560

6279
5750
12629
601

7267
9221
8046
8046
6464
2299
4855
8987
3842

63.8
63.7
58.9
4.8

242 candles per H.P.

1954
7701
~~8388~~
8043

58 B

24 Candles

768
265
533

6279
5500
11779
58.9

17574
9221

8353
8353
6464
2000

5170

4830
8987

3817

68.4

+5

241

24 candles

264
286

572

6279
6350

12629
63.14

7284
9221

8063
8163
6464
2644

5234

4766
8987

3753

64

+ 5.3

23 7 candles per H.P.

50 13

24 candles

265
270

535

6279
4600

10879
54.4

7308
9221
8087
8087
1464
2549
5187

4913
8787
3700

64.4

234 candles
for H. P.

36 B

24 Candles

273
265
538

6279
4850
11129
55.6

5705
9221
6484
6484
6464
4237
3669
6331
7226
3557

44.5 Volts

5185
20.41
7226

226 Candles for H.P.

B. 21 C

16 candles

184
188
372

6279
1270
17549
37.7

3515
5763
8388.
7666

58.4
37.7
20.7 Ohms

6064
9221
6933
6833
6464
3605
3535

6465
7226
3691

234 candles

22 C

16 candles

200
204
404

3167
8395
8385
7950

6279
2450
8729
43.6

62.4
43.6
+ 18.8

5798
9221
6577
6577
6464
3936
3554 → 2226
8446
7226
3672 233 candles per H.P.

26 C

16 candles

188
192
380

3423
6064
8388
7875

6279
1800
18079
40.39

613
40.3
21 ohms

5966
9221

6745
6745
6464
3915

3869

6131
·7226

3357 216 candles per H.P.

27 C

16 candles

195
200

395

6279
1850

8129
40.6

3255
6085
8388

7728

59.3
40.6

+ ~~1~~8.7

6232
9221
7011
7011
6464
3316
3802

240 candles per H.P.

25 C

16 Candles

208
212
420

2989
6684
8388
7981

3050
6279
9329
46.6 + 62.8
46.6
16.2

5729
9221
6508
6508
6464
4045
3525

225

23 e

16 Candles

185
189
374

1600
6279
7879
39.4

3492
5955
8388
7835

60.7
39.4
21.3

5763
9221
6542
6542
6464
4157
3699

234

28 C

16 candles

185
192
377

6279
1400
7679
38.4

3458
5843
8388
7687

58.7
38.4
+ 20.3

5694
9221

6473
6473
6464
4145

3555

6445
7226

232 3671

~~16~~ 24 d

16 candles

183
186

371

1420
6279

2 | 7699

38.5

3527
5855
8385

7770

59.8
38.5

21.3

6075
9221
6854
6804
6464
3152
3324
6676
7226
245 3702

48.5

29 C

16 Candles

200
205
405

6279
3400
9679
48.39

3146
6848
8388
8382

68.9
48.3
20.6

188 2.2742
1.3345
.9397

8.7

.7738
9397
8341

68.2 Volts

8341
6464
2821
5967
4033
8987
3020

200 candles per H.P.

B.65 Retested

Has been very high for short time
20 cells 93.5
94.5
188.0

24 C

247
247
5974

1659
7179
8388
7226

6279
4170
10449
52.24

.5 Ohm

7284
9397
7887 61.5
7887
6464
2499
4737 2990
5263
8987
4250 266

B 36 Retested

24 C

~~265.5~~

262
263
535

6279
4970
11249
56.25

2113
7501
8388
8002

63.1
56.25
6.85 Thm

2 .7589
9397
8192 66
8192
.6464
1857
4705
5295
8987
4282 268

7634
9397
8237 66.6 1763
8237 7993
65.2 8388
63.1 8144
+ 2.

B 46 Retested

24 Candles

287
574

6279
6750
13029
85.14

1808
8143
8388
8339

68.2
65
+ 3.2 Ohm

Brought up very high and retested

~~289~~ 290
290
580

6279
6350
12629
63.1

7482
9397
8085
8085
6464
1778
4412
5588
8987
4575

64.3 Volts

1915
8222
8388
8525

71.2
66.4
286 4.8

B 35 Retested

24 candles

280
560

6279
7000
13279
66.4

7582
9397
8185 65.8
8185
6464
1886
4720 2960
5280
8987
4267 267

B 60. Retested

24 candles

1815
8114
288 8388
285 8317
573

6670 67.9
6279 65.8
12949 +2.1
6475

7152
9397
7755
7755 59.6

24 candles

260
259
519

2245
7002
8388
7635

6279
3770
10049
5024

58.
50.24
+8.24

6990
9397

7593
7593
6464
2807

4457

5543

57.5 Volts

2407
7193
8388

7788

62.9
52.4

+ 10.5 Ohms

59 B Retested

24 candles

250
250

500

6279
4300

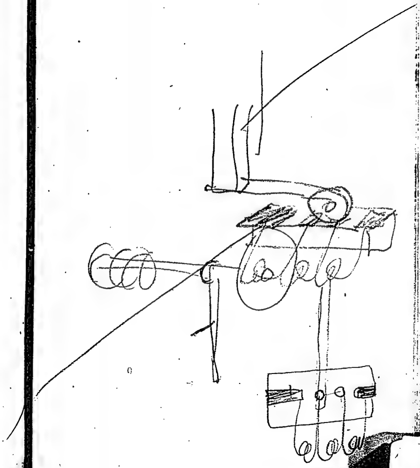
10.579
52.4

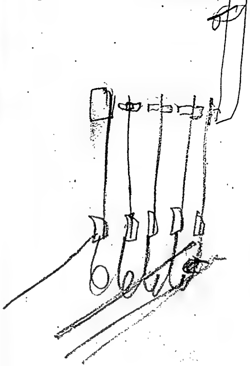
507 : 493 :: X : .0187

.0187
507
3549
4056
507

493) 9.4809 (.019
493
4550
3944
606

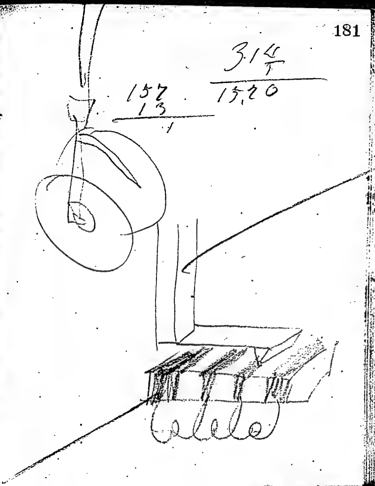
2





3.14
5
15.20

157
13
.1



Menlo Park Notebook #158 [N-81-03-22]

This notebook is undated with the exception of one entry for March 22, 1881. All of the entries are by Francis Upton. Edison's name or initials appear on many of the entries. The book contains notes, calculations, and a few drawings relating to conductors for the Pearl Street district. The label on the front cover is marked "Conductors." The book contains 284 numbered pages.

Blank pages not filmed: 184-277, 280-281.

x E-172 N-81.03.22

1

I propose as a system to carry around each square a wire of uniform size so that only 2.5 Volts shall be lost in the wire. Also to connect in the interior each distributing point with the other points so that there will be a fall of 2.5 Volts along the distributing wires.

The increase of weight due to making the cable of uniform size is 1.165 times as much as when it is decreasing.

$$\log 1.165 = \begin{array}{r} 0655 \\ 19 \\ \hline .0664 \end{array}$$

$$\text{T A Ed} \quad \begin{array}{r} 6.3933 \\ \hline 6.4597 \end{array}$$

Block 1

$$\begin{array}{r} 3.1314 \\ .0664 \\ \hline 3.1978 \end{array}$$

1570

$$\begin{array}{r} 3.0503 \\ .0664 \\ \hline 3.1167 \end{array}$$

1380

Block 2

486	6.4597
489	2.7528
20	2.7528
137	33 1.5185
2 | 1132	3.4838
566	3040

Block 3

574		6.4597		
510		2.7709		
20		2.7709		
137	30	1.4771		
1181		3.4786		3081
590				

TAS

Block 4

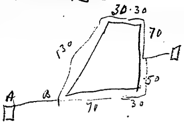
1020
87
20
1127
5~~6~~3

3.4

6.4597
2.7505
2.7505
1.5315
3.4922

3110

Block 5



20
10
8
51
162 A.B. 10 lamps to

3.2 lbs
20
6 4.0

230 1.3617
64 1.8062
3.1679

1470

2 Volts fall around block

160 lamps

5 ⟌1030
206
1236

3.0920
.0664
3.1584

1440

904 2.1956 2
.0664
3.0226

1.050

80 6.4567
say 200 2.4771
2.4771
0.9031
2.1140

130
4090

Block 6

4 P&

3.1313
.0664
3.1977

1570

689

2.5229
.0664
2.5893

388

10
64
20
328
44
466
233

6.4567
2.3674
2.3674
12 1.0792
2.2707

186
2144

Block 8

529

3.1191
.0664
3.1855

1535

6.4597
2.0792
2.0792
0.4771
1.0952

120 3.0

12

Block 9

3796

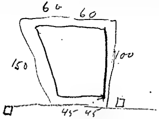
148
20
341
10
30
549

6.4567
2.7396
2.7396
1.2041
3.1400

16

1380
5176

Block 9



150
60
45
255

150 feet

2.81
20
56.20
25.5

1.7497
1.4065
3.1562

lbs 1430

376
10
20
148
554

21

6.4597
2.7435
2.7435
1.3222
3.2689

5 | 1850
370
2220

2220

185
40
10
235
117

9

6.4597
2.3711
2.3711
0.9542
2.1661

146
3796

Block 10.

$$\begin{array}{r} 3.1278 \\ .0664 \\ \hline 3.1942 \end{array}$$

1560

KAS

Block 11

$$\begin{array}{r} 3.1074 \\ .0664 \\ \hline 3.1738 \end{array}$$

$$\begin{array}{r} 1500 \\ 200 \\ \hline 1700 \end{array}$$

TAE

Block 12

30	6.4597	
19	2.6284	200
140	2.6284	
20	22 1.3424	1140
500	3.0589	1340
20		
108		
13		
850		
425		

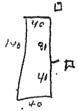
TAE

Block 13

1000	6.4597
40	2.8209
40	2.8209
130	24 1.3802
115	
1325	3.4817
662	

$\boxed{3020}$

Fed entirely from one side



30
136
20
300
20
115
166

TAE

Block 13

920 feet

396 feet
2
792

1840
792

105.8
20.

46
16
20

105.8
11.0

105.8
1058
1163.8

20
20
220

1163
220
~~[illegible]~~
943

w = weight of wire
a = Cross section in 0.0001
l = length .unit =
r resistance

W = Wt. of a wire two feet long the cross section of wh. is 0.0001 sq.in.

R = Resistance of wire two feet long with cross section of 0.0001 sq.in.

$w = l\,a\,W$ TAF

$a = \frac{w}{l\,W}$

2000 feet unit wire weighs 500 lbs. and has a cross section of .0324 sq. in.

Cross section of 0.0001 sq.in.

$\frac{500}{.0324}$ lbs 15-1

2.6990
2.5105
.1885
3.3010 in 2000 feet

log W = 6.8875
Comp log W = 3.1125

4941
3203
8144

Around block
1512
3915
2940
8367

Block 1

604
20
20
644 feet

2.8089
2.8089
27 1.4314
7.0492
6.3933
3.4427
.0664
3.5091

2777
3203

3.5091
7.1910
3.1125
.8127

TAE

.6510

3.2773
7.2306
3.1125
3.6204 .4170

2.7305
7.3696
3.1125
3.2126 .1630

1.5575
7.7520
3.1125
2.4223 .0290

Block 2

Decreasing Straight

2.7694
2.7694
1.2788
6.3933
3.2109
.0664
3.2773

385
30
20
143
10
588

16200 1890

TAE

387
10
30
427

2.6304
2.6304
1.
6.3933
2.6641
.6664
2.7305

461 537

137
10
30
177

2.2480
2.2480
0.6021
6.3933
1.4914
.0664
5578

31 36
2112 2463

Block 3

514
510
137
20
20

1201

600

2.7782
2.7782
30 1.4771 2670 3110
6.3933

3.4268
0664

3.4932
7.2218
3.1125

3.8275 .672

TAE

Block 4

1020
80
20
35
1155
577

34

2.7612
2.7612
1.5315
6.3933
3.4472
.0664
3.5136
7.2348
3.1125
3.8649

2800 3260

TAE

.732

4.4780
2.5611
1.9169
− 82

C = 20
20
264
20
20
364
182
82
.100

6
4

Block 5

$$X = \frac{(b-a)(b+a)F}{6EC} + \frac{C}{2}$$

a = 472
b = 762
C = 1022
30
1052
526

762
472
290

472
762
1234

3.0912
2.4624
8.9254
4.4780
3.0220
1.4560

TAE

10.52
554
498

526
28
554
498

30
10
400
20
460

Decreasing
Same size

1.4560
.0664
1.3896

24.5

2.9862
7.3098
3.1125
3.4085 .256

3.1632
7.2503
3.1125
3.5260 .336

2.1910
7.5719
3.1125
2.8754 .075

Block 5

30
10
100
20
30
490

2.6902
2.6902
14 1.1761
6.3933
2.9198
.0664
2.9862

831 .969

TAE

1052
490
562

2.7497
2.7497
16 1.2041
6.3933
3.0968
.0664
3.1632

1250 1450

264
66 364
30 96
96 268

1.9823
1.9823
25 0.3979
6.3933
.7558

7.5 10

266

2.4281
2.4281
0.8751
6.3933
2.1246
.0664
2.1910

133. 155
2289. 2584

3.2689
7.256 5
3.1125
3.6379 .433

2.1197
7.5591
3.1125
2.7913 .069

2.7489
7.332 5
3.1125
3.1939 .156

Blocks 64 7

267
53
214
20
198
25
64
10
33
554
328
82
240
30
276

30
162
25
190
58
46.5

2.7435
2.7435
0.3222
6.3933
3.2025
.0664
3.2689

2.4409
2.4409
0.7782
6.3933
2.0533
0664
2.1197

2.6675
2.6675
0.9542
6.3933
2.6825
0664
2.7489

1590 1850

TAE

113 131

481 561
2184 2542

3.2699
7.2343
3.1.25
3.6167 .414

1.3664
7.7852
3.1125
2.1641 .0145

Block 8

529
.34
20
583

2.7657
2.7657
19 1.2788
6 3933
3.2035
.0664
3.2699

1600 1860

110
54
164

2.2148
2.2148
0.4771
6.3933
1.3000
.0664
1.3664

TAE

20 22
1620 1882

2.8746
7.3809
3.1125

3.3680 .233

3.4885
7.1568
3.1125

3.7578 .572

Block 9

376 2.6191
10 2.6191
30 .15 1.1761
416 6.3933

½2.8076
.0664

2.8740

642 748

TAE

296 2.8432
10 2.8432
20 1.3424
841 6.3933
30
697 3.4221
.0664
3.4885

2640 3080
3282 3825

3.3762
7.2226
3.1125
3.7113

.514

Block 10

20
30
~~1099~~
549
55
599

2.7774
2.7774
23 1.3617
6.3933
3.3098 2040 2380
.0664
3.3762
7.6383
1.0145 TAE

10.3 lbs per lamp in distributing main
14.3
24.6 lbs per lamp

$7.38 investment per lamp 100 Ohms

$3.64 for 200 Ohm lamp

36400 for 10000 Lamps

2112
2287
1722
6121

All round
2830
1090
2745
6665

2.6071
7.4634
3.1125
3.1230 .132

1.2069
.0664
1.2732
7.8152
3.1125
2.3009 .0200

3.0138
.0664
2.0802
7.2628
3.1125
3.4555 .285

2.6829
7.3990
3.1125
2.1944 .156

Block 11

20
193
20
162
395

25966
2.5966
0.9542
6.3933
2.5407
.0664
2.6071

347 405

1492
123
20
10
153

2.1847
2.1847
0.5441
6.3933
1.3068

TAE

20.2 25

487
162
325
20
188
13
546

2.7372
2.7372
1.1461
6.3933
3.0138

1030 1200

492
123
369
30
399

2.6010
2.6010
1.0212
6.3933
2.6165
.0664
2.6829

413 882
1810 2112

3.3394
7.1878
3.1125
3.6397

.436

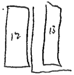
Block 12 & 13

500
24
11.5
1.0
649

2.8122
2.8122
18) 1.2553
6.3933
3.2730
.0664
3.3394

1875

2180



TAE

3.0333
7.2924
3.1125
3.4382 .274

456 2.6590
7.9031
3.1125
3.6746 .472

Block 13

500
10

2.7076
2.7078
1.0792
6.3933
2.8877
.0792
2.9669
.0664
3.0333

You have to give 2 Valves +20% in distrib

TAE

~~772~~

926 1080

456 456
1382 1536

~~125~~
125 feet

1.9 lbs
20
38.0
12.0
760
34
456.0

20

249

2.3962
2.3962
0.7782
6.3933
1.9639

92 110
1474 1646

Block 14

100	2.2095		
	2.2095		
162	.3010		
	3010		
	6.3933		
	1.5743	32	40

TAE

180	2.2553		
	2.2553		
1/4 Volts	.3010		
	.3010		
	6.3933		
	1.5059	32	40
		10	10
		74	90

Block 15

268
20
10
298

$$x = \frac{(b-a)(b+a)\,F}{6\,E\,C} + \frac{c}{2}$$

762
298
1066

762
298
464

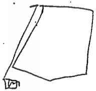
2.6665
3.0253
89254
4.6172
.24742
2.1430

TAE

2) 298
149

139

Feed all



2.4742
2.4742
$\emptyset$.
6.3933
2.3417

200 2~~2~~5

243
10
20
10
283

2.4518
2.4518
1.
6.3933.
~~6.3866~~
2.2979

198 225
398

Block 16

200 225

TAE

268
10
278

2.4440
2.4440
.7782
5.6662
2.0596

230
124
354

270
150
420

Block. 17

15
35
220

$$x = \frac{(b-a)(b+a)\,f}{6\,E.\,C.} + \frac{C}{2}$$

b = 831   831
a = 220   220
611   1051

TAE

363
13
20
264
10
674
337

3.6216
2.7860
8.9254
4.7330
2.8287
1.9043

337
80.2
417

363
33
396

2.5977
2.5977
.7782
6.3933
2.3669
.0664
2.4333

230   270

Block 18

One side

Same as Block 17	230	270
Trees	150	150

TAE

Block 19

1.0	2.2967
262	2.2967
2.0	0.9542
95	6.3933
10	
397	1.9409 873
198	

Block 20

.40	2.2765		
298	2.2765		
40	0.9031		
378	6.3933		
139	1.8494	70	90

40	2.6138		
192	2.6138		
20	1.1461		
320	6.3933		
20			
191	2.7670	588	681
40	.0654		
023	.8337		
111		658	771

2 | 314
157
·0
167

Block 21

2.04
30

2.3617
2.3617
.6021
68937
1.7188

THE

	60	80
	90	110
	90	110
Estimated	240	300

Block 22

370	2.3617
35	2.3417
35	1.0792
20	6.3933
$\boxed{460}$	
230	2.1959

TAE

157 180

Block 23

Same as Block 7 230 270

275
36
311

2.4928
2.4928

6.5933
2.3789

240 280
470 550

THE

1/10

220
370
59
210
164

.286
50
20
56
412

2.6149
2.6149
1.0414
6.3733
2.6645 462 550
.0664
.7309

8.0

1.9031
1.9031
0.4771
6.2933
5746 10 12

Estimated 50 60
10 12
532.634

Block 24

$$x = \frac{(b-a)(b+a)7}{6 \cdot 8 \cdot c} + \frac{c}{2}$$

b = 1046
a = 364
1046
364
b − a = 682
1046
364
b + a = 1410

3.1492
2.8338
8.9254
4.9104
2.7642
2.1462

298
140
158

215
158
057
10
067

TAE

33
32
285
350

35
63
98

1.9912
1.9912
.3010
6.2933
.6767

428
350
78

378
98
280
33
32

2.5378
2.5378
1.0969
6.3913
2.5658 368 429
.0664
2.6322

26

38
282
20
35
426

2.6294
2.6294
1.0792
6.2930
2.7313
.0664
2.7977 538 624
916 1069

Over

Block 25

$a = 634$
$b = 1046$
1680

$X = \frac{(b-a)(b+a)\,7}{6\,\Sigma\,C}$

1046
634
412

3.2253
2.6149
8.9254
4.8656
2.6866
2.1790

TAE

33
32
378
10
33
476
213

33
32
285
428
.20
282
35
1115
557
66
623

151
243
394
65
329

4.8656
3.0472
1.8184 66

712 feet
2630
~~3699~~ lbs

~~.00..7~~

63 lbs.

.0115

2630 3.4200
63 1.7993
1.6207

41.8 1.6207
.0057 3.7559
7.3866
~~.273~~ .3010
.238 7.6776

.476

Block 25

916 .1069

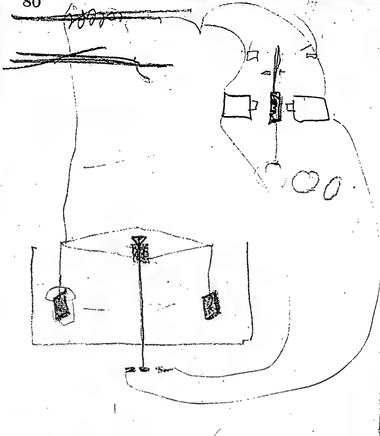
.286 2.8525
66 2.8525
342 1.2553
20 6.3933
285 3.3536
22 .0664
33 3.4200
10 2.2553
712 180 1.1647

2260 2630
3176 3699

THE

(14.5 lbs. per lamp
7.25 per another lamp

3.4200
7.1474
3.1125
3.6799 .478



Block 26

a = 220
b = 364
584

364
220
144

2.1584
2.7664
8.9254
3.8502
2.7427
1.1675

TAE

10
193
020
320
10
553
276
12
288
203
85

10
193
20
80
303

2.4814
2.4814
0.8129
6.1933
2.1690

147 170

Oben

Block 26

147 170

320
60
240
10
250

2.3979
2.3979
0.6532
6.3933
1.8423

TAE

70 80

217 250

214

2.3314
2.3314
0.6021
6.3933
1.6582

455 535

307

2.4871
2.4871
1.1461
6.3933
2.5136
.0664
2.5800

Done away with

326 380

588 685

Block 27

20	25
80	95
100	120

.218
37
5 5

2.4065
2.4065
0.6990
6.3933
1.9058

TAE

Block 28

43		2.7490		
864		2.7490		
10	26	1.4150		
195		6.3933		
10		3.3063	2020	2360
1122		.0664		
561		3727	TAE	

Dick 29

13
10
0
179
20
138
20
57
20
128
10
452
76
33
409

2.6117
2.6117
1.1903
6.3933
2.8070
.0664
2.8734

641 747

THE

200
10
20
230

2.3617
2.3617
.9031
6.3933
2.0198

108 1..

200
213
20
112
266

2.5623
2.5623
1.1139
6.3932
2.6318
.0664
2.6982

10
113

428 499

112
10
122

2.0564
2.0864
0.6990
6.3933
1.2651

.18 25
659 661

Block 30

$$X = \frac{(b-a)(b+a)7}{6EC} + \frac{c}{2}$$

a = 479
b = 752
1231

752
479
273

TAE

3.0899
2.4362
8.9254
4.4515
2.4683
1.9832

244
10
20
20
294
147
962
508

4.4515
2.8129
1.6386

90.2

435

29
174
20
225
20
213
29
650

Block 31

20 25

124
10
10
10
246
20
84
5.04

2.7024
2.7024
1.0792
64840
6.3933
2.8773
.0664
2.9437

TAE

754 878

232
35
32
299

2.4757
2.4757
9031
6.3933
2.2478
0664
2.3142

177 207
951 1100

Block 32

$$\begin{array}{r} 2.9706 \\ .0664 \\ \hline 3.0370 \end{array}$$

935 1090

TAE

287
57
230
10
18
258

2.4116
2.4116
0.6812
6.3933
1.8977

79 85
2 3

57
28
18
88

1.4294
1.4294
8.0792
6.3933
3.313

130
10
140

2.1614
2.1614
8.3979
6.3932
1.1140

13 15

18
97
20
270
10
415

2.6180
2.6180
0.9021
6.3933
2.5324
.0664
2.5988

341 397
435 500

Block 33

$$\lambda = \frac{(b-a)(b+a)\,f}{6\,\Sigma C} + \frac{C}{Z}$$

a = 220
b = 537
757

537
220
317

TAE

2.8791
2.5011
8.9254
4.3056
2.5224
1.8832 76.4

287
10
18
18
333
166
76.4
2424

27
28
219
274

2.4378
2.4378
0.6021
6.3933
1.8710

74 90

27
28
193
20
105
373

2.5717
2.5717
0.6990
6.3933
2.2357
.0660
.3021

172 210

105
10
115

2.0607
2.0607
.3010
6.3933
.8157

6.5 7.5
2525 2975

Block 34

$x = (b-a)(b+a)$

a = 537
b = 1051
1588

1051
537
514

TA4

27
28
193
20
211
10
489
244
140
104

3.2010
2.7110
8.9254
4.8374
2.6898
2.1476

140

Block 35

167	2.0899
10	2.0899
10	0.6021
30	6.3933
30	
247	1.1752
123	

15 20

TAE

10	2.6749
10	2.6749
30	1.3010
30	6.3933
310	3.0441
~~20~~	.0664
186	3.1105
20	
330	
946	
473	

1100 1290

1115

479
27
213
32
753

Block 36

598
16
156
4|0
774
387
14
401

2.6031
2.6031
1.2553
6.3933
2.8548
.0664
2.9212

7/6 834

TAE

Blocks 37 & 38

10	2.3579
135	2.3579
24	0.8451
59	6.3933
228	1.9542
	.0664
	2.0206

90

105

TAE

Block 39

200 20 25

2.3010
2.3010
0.4771
6.3933
11.4724

30 35
50 60

TAE

Block 40

196
20
177
10

100 120

TAEDISON

Block 41

10
15
20
158
40
3

73 90

TAEDISON

Block 42

60 75

T A EDISON

Block 43

1792
396
50
456

2.6590
2.6590
1.1761
6.3933
2.8874
.0664
9538

771 899

30 40

801 939

Block 44

468
50
336

2.7308
2.7308
1.3424
6.3933
3.1973
.0664
2637

1570 1830

TAE

Block 45

20	25
140	170
160	195

Block 46

30
10
227
20
114
401

2.6031
2.6031
0.9542
6.3933
2.5537
.0664
2.6201

357 .417

40 60
397 457

Tie

Block 47

192 220

TAE

Block 48

409	2.6425	
30	2.6425	
429	1.2304	
	6.3933	
	2.8087	644 .750
	.0664	
	.8751	
215	2.3324	
	2.3324	
	.6021	45 60
	6.3933	
	1.6502	689 810

TAE

Block 49

418
30
448

2.6513
2.6513
1.3010
8.3933

2.9969 993 1150
.0664

3.0633

TAE

Block 50

Im! 240

TAE

Block 51.

490	2.7482		
30	2.7482		
40	1.1061		
560	6.3933		
	3.0368	1100	.260
	.0664		
	3.1032		

TAE

6029
2112
330) 8151

3.9112
2.5185
1.3927

24.7 lbs cu. per 100 Ohm lamp

84

52,300   4.7185   61,000
.0664   52.300
4.7849   8.700

61,000 lbs

61.000
88983
149983. lbs to supply
Dynamo

	2777	30 —	559
	2112		951
	2670		935
	2800		435
5 —	2289		2525
64	2184	35 —	1115
	1620		716
	3282	37.38 —	90
			50
10 —	2040	40	100
	1810		73
	1875		60
13	1474		801
	74		1570
		45 —	160
15 —	398		397
	200		192
	354		689
	150		993
	873		200
20	658		1100
	240		14711
	157		37564
	470		52275
	532		
	3176		
	588		
	100		
	2020		
	641		
	37564		

TAE

Station at corner No. 1
to have the conductors brought
a shorter route.

21 Stations now for distribution

~~|||||~~ | ~~||||~~ ~~||||~~

16 separate lines

396	220
15	10
268	370
10	58
689	215
	10
	883

396 of 1013 feet
100
10
162
10
20
130
35
140
10
1013
160
853

3429	4971
4191	6039
1587	2287
1397	2013
10604	15116

15116
10604
4512 lbs less
30
$1354.60 saved

~~$3~~3
90
2970

TAE

4512
1221
5733
~~1759~~

4191
2970
1221 lbs by making new station
30
$366.30
1354
271030

Lamps

50

200 hours each lamp
for fifty cts

$\frac{200}{8} = 22.2$ hours
for a H. P

2.2.2) 500 (2.2 [illegible]
444
560

$\frac{200}{8} = 2.5$

~~2.5) 5~~   2.5) 500 (2 cts an hour

50 cts   Lamps

50 cts cost per H.P at 9 per H.P

3200

50 cts ~~for~~ cost

7 per H.P. 12 candles each
600 hours   TAE

~~300 hours~~

~~200 hours H.P. 9 H.P~~

9 per H.P. 16 candles each
300 hours

Lamps 85 cts each

~~600~~

600
85
3000

3.000
For lamps $11\frac{2}{3}$ cts per H

Lamps

50 cts for HH.
at 8 per H.P.

50 cts for 200 hours
for one burning

50 cts for $\frac{200}{8}$ ~~horse~~ hours
~~hours~~ for one
horse power

50 cts for 25 horse
power for one
hour

2 cts. for 1 horse
power for one
hour

Lamps

2cts

$7\overline{)400}$
57.1

$\frac{2}{7} \times 200 = 57.1$ cts per HH
11.66
Total cost = 66.76 cts

$7\overline{)400}$
44.4

$\frac{2}{9} \times 200 = 44.4$ cts per HH

Lamp cost

11.66
2
23.33 cts

TAE

44.4
23.3
67.7 cts

Lamps

1000 feet

60 lbs per [illegible]

12 cand

25
60
1.50 per M

TAE

16
8
84 candles incandescence

7 per H.P 20 lbs. per 1000 candles.

$\frac{2}{7}$ per lamp per hour

$\frac{2}{7} \times \frac{\overset{500}{\cancel{1000}}}{\underset{63}{\cancel{12}}}$ per 1000 candles

12
7
84

21) 500 (23.8
42
80
63
170

Lamps

lamp ~~Cast~~ 6000 hours
costing 35 cts

$$\frac{\begin{array}{r}600\\12\end{array}}{7200}$$ candles for 35. cts

$$\begin{array}{ll} 3.5. & 1.5441 \\ 7.2 & 0.8573 \\ \hline & 6868 \end{array}$$

4.8 cts

TAE

$$\begin{array}{r} 23.8 \\ 4.8 \\ \hline 28.6 \end{array}$$ Total cost

144 candles incan. 300 Hours Lamps
9 per H.P. of 16 candles

$$\frac{\cancel{2}}{9} \times \frac{\cancel{1000}\ 125}{\cancel{16}\ 8} = 13.9 \text{ cts}$$

$$\begin{array}{r} .16 \\ 9 \\ \hline 1.44 \end{array}$$

$$9\,)\,125 \quad 13.9$$

14.45 ; 17.60 :: 15.79

$$\begin{array}{r} 1.1959 \\ 1.2455 \\ 8.8416 \\ \hline 1.2830 \end{array}$$

TAE

19.20

$$\begin{array}{r} 4.8 \\ 2 \\ \hline 9.6 \end{array}$$

Total cost $\begin{array}{r} 13.9 \\ 9.6 \\ \hline 23.5 \end{array}$ cts

~~10 of 12~~
9 of 12

883	831
44	44
290	112
10	40
	180
	10
1221	1217

Station at corner of Block 24 can be made 883 feet from central station

Lamps
90
145
65
110
405

1240
1960
912
1575
5687
3908
1789

96.5
40.5
48.25
3860
3908.25

TAE

1779 lbs Cu

from page 135

5773
1779
7552

149.983
7.552
142.431
128.506
13.925 lbs more than other system

Length of distributing wire in system where it is run separately from all other wires.

35,457 feet

TAE

TAE

Data from which the preceding calculations are made

The lamps are The assumed to have a resistance of 100 Ohms. 30 lamps placed 60' apart on a line 1800 feet long, so that there would be a resistance of 10 Ohms to each lamp if the conductor were made up of separate strands. Both conducting wires together weigh 440.7 pounds, and if at the machine there is 100 Volts tension between the lines there will be 87.6 Volts at the lamp 1800 feet from the machine or a drop of 12.4 Volts.

a

The fall in E. M. F. will be inversely proportional to the amount of copper in the conductor. There will be the same proportional fall for 10 lamps 180' apart as for 30 if there is 1/3 the amount of copper in the conductor.

i.e. $\frac{4901.7}{3} = 1469$ lbs TAE

The amount of copper required varies as the square of the distance that the lamps are apart, ~~and~~ or as the ~~distan~~ square of the distance of the furthest removed lamp.

Let a = distance to extreme lamp.

b = number of lamps $\div$ 10

C = amount of copper in conductor

x = Fall E.M.F. on conductor a feet long with b lamps on it, & weighing c pounds.

$1800^2 : a^2 :: 146.9 : d$ ~~Ta?~~

$$d = \frac{146.9\,a^2}{1800^2}$$

d = amount copper that will give 12.4 Volts fall on a conductor a feet long with 10 lamps

$12.4 : X :: \frac{c}{b} : d$

$$X = \frac{12.4\,d\,b}{c} = \frac{12.4 \times 146.9\,a^2\,b}{1800^2\,c}$$

If instead of 100 Volts to start with there are 110 Volts at the machine then the fall in E.M.F will be $\frac{1}{10}$ greater

$12.4 + 1.24 = 13.64$ Volts

Then $X = \dfrac{13.64 \times 146.9\, a^2 b}{1800^2\, c}$

Let $x = 2.5$ volts it is required to find the value of C for ~~b~~ lamps at a feet from machine

$$X = \frac{13.64 \times 146.9 \times a^2 b}{1800^2\, C}$$

$$C = \frac{13.64 \times 146.9 \times a^2 b}{1800^2 \times \cancel{x}}$$

$$\frac{13.64 \times 146.9}{1800^2} = .000618$$

$$C = \frac{.000618\, a^2 b}{2.5}$$

1.1347
2.1670
6.7447
6.7447
6.7911

$$C = .0002473\, a^2 b x$$

2.5 0.3979
6.3932

$$C = \frac{.000618\, a^2 b}{2.5}$$

$$C = .000247\, a^2 b$$

$$\log .000247 = 6.3932$$

$$\begin{array}{r} 100 \\ 5.24 \\ \hline 94.76 \end{array}$$

I worked this out
in another book and
am quite sure that
it is right
March 22 1881 [illegible]

Conductor of the same size
for the whole length with
Ten lamps on it 180 feet
apart the total resistance
of the conductor being 1 Ohm
If at the machine there
are 100 Volts at the end
of the conductor there will [illegible]
be 94.76 Volts or a fall
of 5.24 Volts. If at the
machine there is 110 Volts
there will be a fall of
5.764 Volts on the line
and take 405 lbs of Cu
in the line 1800 feet long.

Since the fall is inversely
proportional to the amount of
copper used in the mains,
to compare with the conductor
in which there was a fall
of 13.64 Volts, there will
be n pounds of copper in
the uniform sized conductors
to give the same fall.

$$5.764 : 13.64 :: n : 405$$

$$n = \frac{405 \times 5.764}{13.64} = 171.2$$

$$\begin{array}{r} 2.6075 \\ 0.7607 \\ 8.8652 \\ \hline 2.2334 \end{array}$$

$\log n = 2.2334$
$\log 146.9 = \underline{2.1670}$
$.0664$

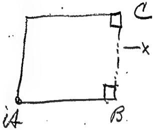
(page 155a)

That is it require 1.165 times
as much copper for a straight

conductor as it does for a decreasing conductor to give the same fall of E. M. F.

TAE

To find the best point
to run the wires to in
feed a distributing wire
from both ends



TAF

Let $AC = a$
$AB = b$
$Cx = X$
$CB = C$
$Bx = C - X$

If there are n lamps along
the ~~conductor~~ BC

$\frac{X}{C} n$ will be fed from C
$\frac{C-X}{C} n$ " " " " B.

Data for $\mathcal{F}$

10 lamps at 10 feet require .0125 lbs of Cu.

at 1 foot 1 lamp

$$\frac{.0125}{1000} = .0000125$$

Datum for $\mathcal{E}$

16 lamps on 1800 feet require 146.9 lbs of Cu

146.9	2.1670
Comp 10.	9.
Comp 1800	6.7447
comp 1800	6.7447
	4.6564 −10
	1.1347
	9.6021 − 10
	5.3932
	.0664
	5.4596

Let $\mathcal{F}$ = The weight of copper required in the main line to feed a lamp at a distance of one foot.

& $\mathcal{E}$ = The weight of copper required in the distributing wires to feed one lamp at a distance of one foot from distributing point.

$\mathcal{F} = .0000125$ Log $\mathcal{F} = 5.0969$

Decreasing conductor

$\mathcal{E} = 0.00002473$ log $\mathcal{E} = 5.3932$

Uniform sized conductor

$\mathcal{E} = 0.00002882$ log $\mathcal{E} = 5.4596$

The values of $\mathcal{E}$ can be obtained easily by substituting in the last equation on page 161

$a = 1$

$b = 1/10$

To supply $\frac{X}{C} n$ lamps through TA?

requires

$\frac{X}{C} n a^2 \mathcal{F}$ lbs. in main

$\frac{X}{C} n x^2 \mathcal{E}$ lbs. in distributing

To supply $\frac{C-X}{C} n$ lamps from B requires

$\frac{C-X}{C} n b^2 \mathcal{F}$ lbs. in main

$\frac{C-X}{C} n (a-x)^2 \mathcal{E}$ lbs. in distributing

The problem is to make
the sum of these weights
a minimum

$$\frac{x}{c}\, n\, a^2 \mathcal{F} + \frac{x}{c}\, n\, x^2 \mathcal{E}$$
$$+ \frac{c-x}{c}\, n\, b^2 \mathcal{F} + \frac{c-x}{c}\, n\, (c-x)^2 \mathcal{E} = \text{min}$$

Differentiated making equal to zero multiplying by c and dividing by n we have

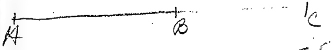
$$a^2 \mathcal{F} + 3x^2 \mathcal{E} - b^2 \mathcal{F} - 3(c-x)^2 \mathcal{E} = 0$$

$$3\cancel{x^2}\mathcal{E} - 3c^2\mathcal{E} + 6cx\mathcal{E} - 3\cancel{\mathcal{E}x^2}$$
$$= b^2\mathcal{F} - a^2\mathcal{F}$$

$$6c\mathcal{E}x = b^2\mathcal{F} - a^2\mathcal{F} + 3c^2\mathcal{E}$$

$$x = \frac{(b-a)(b+a)\mathcal{F}}{6c\mathcal{E}} + \frac{c}{2}$$

To find the most profitable place to feed a distributing system



TAF

AB a uniform wire on which there is a fall of ten Volts. BC an uniform or decreasing wire on which there is a fall of 2.5 Volts

Let $AC = a$

" $AB = x$

" $BC = a - x$

Let 7 = Values on ~~t~~ page 173

& $E =$

$$x^2 \mathcal{J} + (a-x)^2 \mathcal{E} = \min$$

$$x^2 \mathcal{J} + a^2 \mathcal{E} - 2ax\mathcal{E} + x^2\mathcal{E} = \min$$

$$\mathcal{J}x^2 + a^2\mathcal{E} - 2a\mathcal{E}x + \mathcal{E}x^2 = \min$$

$$2\mathcal{J}x - 2a\mathcal{E} + 2\mathcal{E}x = 0$$

$$(2\mathcal{J} + 2\mathcal{E})x = 2a\mathcal{E}$$ Ta?

$$x = \frac{a\mathcal{E}}{\mathcal{J}+\mathcal{E}}$$

$\frac{\mathcal{E}}{\mathcal{J}+\mathcal{E}}$ 247 3.72

$$\begin{array}{r} 0.3927 \\ 0.5705 \\ \hline .8222 \end{array} \qquad \begin{array}{r} .0000125 \\ .0006247 \\ \hline .0000372 \end{array}$$

66.4% for decreasing

$$\begin{array}{r} 125 \\ 288 \\ \hline 413 \end{array}$$

$\frac{18}{12}$ $\frac{12}{6}$

$$\begin{array}{r} 35 \\ 35 \\ \hline 175 \\ 105 \\ \hline 1225 \end{array}$$

2

$$\begin{array}{r} 42 \\ 42 \\ \hline 84 \\ 168 \\ \hline 1764 \end{array}$$

2 Ohms

$\frac{176}{122}$ X 2

61 1.76

T

W. water = $0,\overset{kg}{869}$ ~~[illegible]~~ Kilogram

20' = time

49°,8 temperature

$$\frac{0,869 \times 49{,}°8}{20}$$

0,869
49,8
6952
7821
3476
4,327762

2,1638
~~0,0022~~
4,327762
4327762
4,7600 8

4,76
775
2380
3332
3332
3689,00

775

3689 ft pound

33000 | 3689
33201 | 8,9

33,000

775 | 8,1 | 7/.
7,65 | 8,1

19
2
12) 38"
3'.166

~~200~~
~~£~~100
16.

.150
2
300

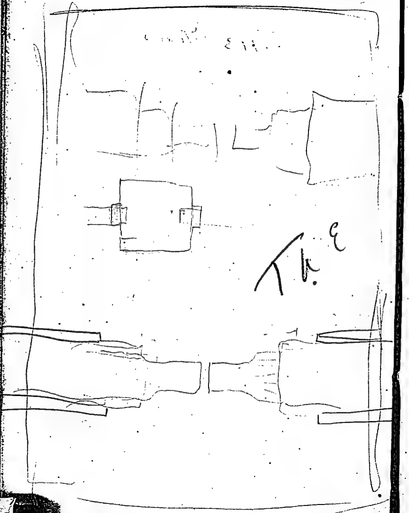
3'.166
15820
158300
3166
475.900

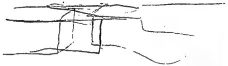
4)475 feet
1.19

175 feet to make Ohm
6
1050
4
4200) 475.0 (.11.3/100
4200
550
420
130

1050

.113 Ohms





Menlo Park Notebook #160 [N-80-06-16.2]

This notebook was probably used on September 23 and September 24, 1880 to record tests made by Edison, Francis Upton, Francis Jehl, and Sigmund Bergmann of gas jets at Bergmann's factory. (See Charles P. Mott's entries of those dates in Menlo Park Notebook #117.) Included also are references to books on gas lighting and a clipping relating to gas light tests made by the New York Department of Public Works. The label on the front cover is marked "Gas." The book contains 282 numbered pages. The last page has been torn out of the book.

Blank pages not filmed: 24-195, 198-235, 238-239, 242-253, 260-273.

WEDNESDAY, JUNE 16, 1880.

Official Report of Examinations of Gas for two Weeks ending June 5, 1880, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

May 1880.	Time of Day at which Test were made.	New York Gas-Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		*	*	†	*	*	†
24	Between	25.65	20.18	26.75	22.30	18.90	29.27
25	9.30 A.M.	24.26	20.26	27.08	22.56	19.28	28.24
26	and	27.61	20.33	25.00	21.82	19.22	28.28
27	1 P.M.	23.41	20.42	25.98	22.01	19.00	26.92
28		24.15	20.14	26.26	21.04	18.06	29.08
29		24.52	20.48	26.32	21.69	18.15	29.15
	Average	24.93	20.29	26.23	21.88	18.77	28.82
31							
June 1		23.81	20.44	25.96	21.24	18.43	29.12
2		19.05	20.36	25.62	21.12	17.96	29.18
3		20.38	19.82	25.08	21.73	17.62	28.72
4		21.84	19.95	25.27	21.65	18.51	28.55
5		24.88	19.84	24.54	22.82	17.90	28.49
	Average	21.89	20.08	25.29	21.71	18.08	28.80

* Five foot lava tip with check.
† Bray's slit union, No. 7.

E. G. Love, Gas Examiner.

This forenoon ... as one of the employees of the

Goodwin Meter Co 142 Chambers
Photometers, Pressure Guages etc

American Meter Co 512 W 22nd

Kings Treatise on Coal gas $10.
AM Callender & Co 42 Pine

Ask Price Amn Gas Jnl from
Commencement to date, 32 Vols —

WEDNESDAY, JUNE 16, 1880.

Official Report of Examinations of Gas for two Weeks ending June 5, 1880, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

May	Time of Day at which	...rk ...ight Co.	...tan ...ight Co.	...ight Co.	...olitan ...ight Co.	...ight Co.	...al ...ight Co.
5		24.88	19.84	24.54	22.82	17.90	28.49
	Average	21.89	20.08	25.29	21.71	18.08	28.80

* Five foot lava tip with check.
† Bray's slit union, No. 7.

E. G. LOVE, Gas Examiner.

THIS forenoon ... as one of the employees of the

Goodwin Meter Co 142 Chambers
Photometers, Pressure Gauges &c

American Meter Co 512 W 22nd St NY

Gas and Water Co Directory ... London - Orders recd Am Gas Light Journal

Cathels, Gas consumers Man... 42 Pine St Room 18. (10) Am Gas Light Journal
A.M. Callender & Co

Fordell's System Gas Burning
$5 = See if we haven't got it

Kings Treatise on Coal gas &c.
A M Callender & Co 42 Pine

Ask Price Am Gas Light Jrl from Commencement to date, 32 Vols —

18/10

730 1/2 time
Read 1 foot

732. 45 sec
Read 5 feet.

5 on	16	9
8	15 7/8	10
9	15 1/2	
10		
12	15	
14	14/10	
15		
16		
17		
18		
19		
20	13/10	
21		
22		
23		
24	12/10	
25		
26		
27		
28		
29		
30	11/10	

At Bergmans. 4th story 50 feet.
pressure measured with a pressure
U shaped bought at goodwins was.

19/10 this =

Upton turned off slightly at meter
gauge 14/10 very noticable diminuation
in size of jet and light, latter very
considerable = 5 lights were on
we noticed that all jets were set
vibrating about 300 per min. —
Could hear no sounds. —

Bergman put on graudually light
by light (5 on) up to 30. when 5 were
on the pressure was 18/10 - when 12
Extra added 15 1/2/10 14 on 14/10
20 added 13/10 — 24 added 12/10
30 added 11/10. This made no
change in first jest except to reduce
its size and amount of light

$\frac{60}{11} \times 25$

```
      60
11)1500
36)136   | 3.8
   108
    280
      8
```

3.8.

7½.

730 . 30.

6

11.

44.

36 Lights on Upton reads
Gas Cos Meter =

7 30½ pm.	Meter reads	1 foot.
7.32. 45 sec.	Reads	~~5~~ feet
7.34 . 55 -	"	11 feet.
7.37 .5		16 "
7 39 .20		21 "
7 ~~40~~ 41 .30		26 "
7 43 45.		31.

~~[illegible]~~

25 feet 11 minutes. in 36 burners, – or 3.8 per burner per hour on testing photometrically we find that the average gas jet with all on (1.0) 36, gave 7½ candles; size of jet

this size,

This was not streaky from high pressure but apparently at the best point for greatest light,

PM —

8.29. 30 — our Meter reads 1/2 foot

8.34. 6-Brays special Lavatip " 1 "

8.43. " 2 "

8 59, 45 " 4

— First test 16 candles —

2 15@16.

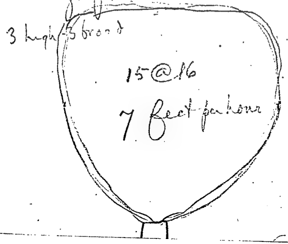
9.17 ——— 6

9.30 7 1/2

Pressure ~~[illegible]~~ at meter at 838,

20/10 — ditto 917 -

Size flame



2

9

30000

150 | 1 1/2

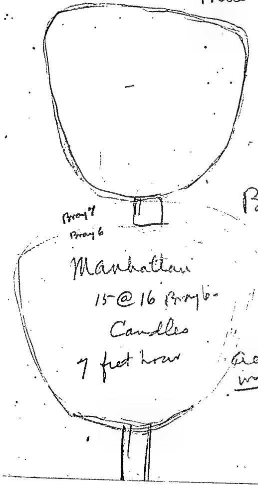
5

7 1/2

7

Frances Sends a wire to
pass over Edges flame

Thus.



1st trial
with wire

Brays

2nd + more
accurate trial
with wire

8 lb 1000

7000

100

66

22

550 - 6

6

21 $2\frac{1}{2}$

21 5

21 $7\frac{1}{2}$ 3

63.

Pressure at 932 - 20/10
1010 same -
1040 19/20

Measurement with Brays
Slit-Union No 7 -

9.40. Meter reads $\frac{1}{2}$
9 52 30 " 2

23 Candles - 1st test -

10.01. 3.
10 10 4.+

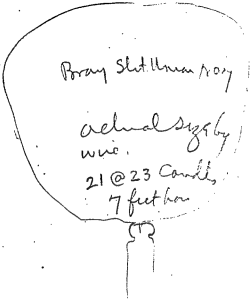
21 @ 22 2nd test, candles

10 26. .6.

23 @ 24 3rd test

10 40 - $7\frac{1}{2}$

just 7 feet


Bray Slit Illum No 7
actual size by wire.
21 @ 23 Candles
7 feet hour

7 1/2
6 1/2
6 1/2
19 1
19

19 13 1
1 26 2
13 52 4

3 1/3

7 min 1/2
1
14 2 7
28 4 1
56

12 3
34 4 1/2 16
9 2
13 1/2

Bergmans ~~[illegible]~~ Brass 2 hold turner burner been working 4 months - Same one that gave 7 candles when 36 lights on + 11/10 pressure now have 19/10 pressure - @ 17/10

1048, Zero

~~8~~ 7 @ 8. Candles -

1055 1/2 foot
1101 1

---

8 @ 9 Candles - pressure 17/10 2nd test.

1107. 1 1/2

---

7 @ 8 Candles

~~2~~ 3

1126

8 @ 9. candles with opal 3 candles

(Pressure. 16 3/4/10

1139. 4 feet
1148. pressure 16/10. 4 6/10 feet

24

5

12

110

8

Brays Union Slit No 7.

Made it. 15 candles,

Pressure - 15/10

1210 Reads	- 3/4 foot
1218	1 1/2
1223.	2
1229 1/2	2 1/2
1235	3.
1240 1/2	3 1/2

2nd test 22 candles. candles [illegible] flow

1252	4 1/2

3rd test 15 candles.

109 am - 6 ~~ft~~ feet

2 7/8.

5/

4)44
11.

3 1/4.

4. 44
4
7)176
25.

27 8.

5 .30 sec 1/2

23.

28.

1/4

7.

1/4 .4.

13 1

Suggs London Argand standard
up as high as it will go without smoking
Reaches nearly to top

am
1.39 - 30 Reads 1/2

1st test 18@19 Cand Pas

1.45. 1

1 49 1/2 1 1/2

6 feet per hour

We now put it down ~~to~~ what the public would use it.

Measures 14 Candles

1.55. 30 - Zero

202 1/2

208 .30 1

72

111111

11

23

5

16,

1 1/2

4

210 am Pressure $15/10$

~~Lighted 36 jets and standard~~

~~[illegible] fell to~~

Bergmann's new Lava tip burner

just bought

231 30 — Reads 1/2

237 15 1

12 @ 13 Candles 1 1/2

242 15 2

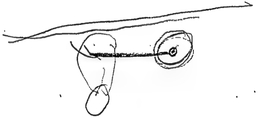
247. 45 2 1/2

254. 30.

With Opal Globe – 2 candles

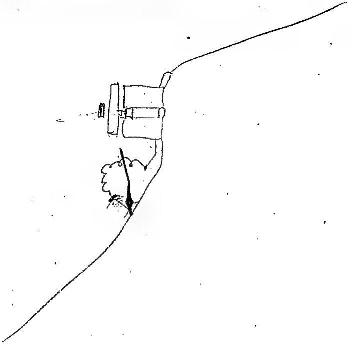
without 12 @ 13.

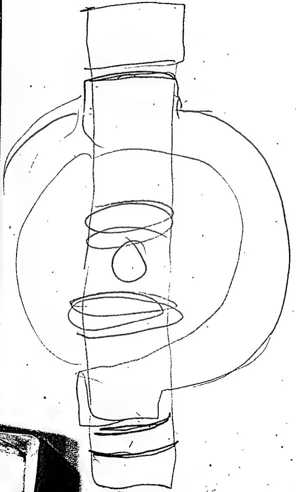
probably 4 candles as it throws some [illegible]



$S = v$

$S = \left(v + \frac{1}{2} f t\right) t$

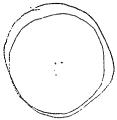




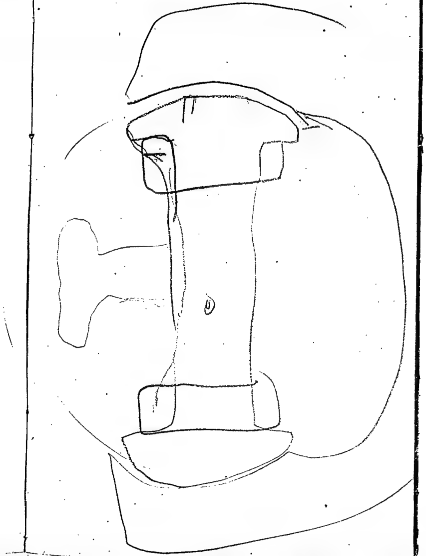
21.

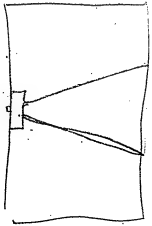
$4\frac{1}{2}$

45



18





$$\begin{array}{r} 1000 \\ 33 \\ \hline 967 \end{array}$$

967 : 33 :: x .0187

$$\begin{array}{r} .0187 \\ .0967 \\ \hline 1309 \\ 1122 \\ 1683 \\ \hline \end{array}$$

$$33 \overline{)\,18.08\,2\,9\,}(.57$$

$$\frac{967}{33} = \frac{x}{.0187}$$

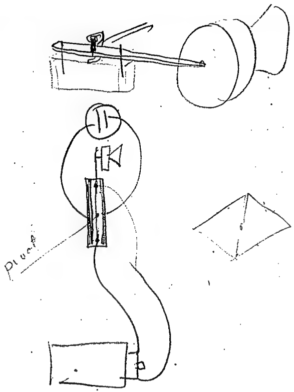
967 × .0187 = 334

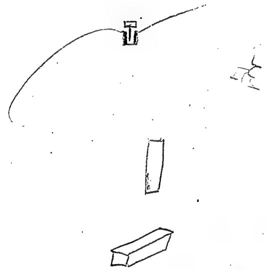
$$\begin{array}{r} 1000 \\ 357 \\ \hline 643 \end{array}$$

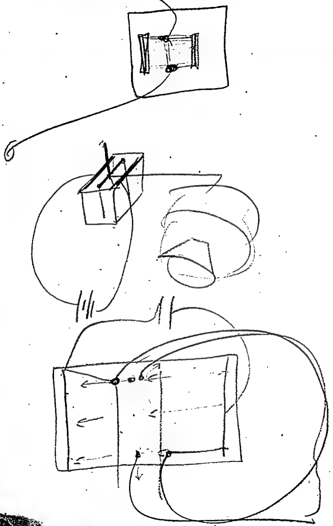
643 : 357 : x : .887

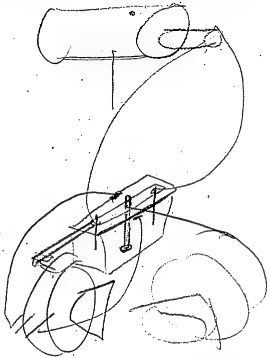
$$\begin{array}{r} .0187 \\ 643 \\ \hline 561 \\ 748 \\ 1122 \\ \hline \end{array}$$

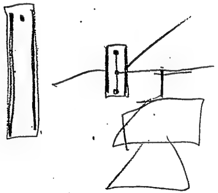
$$357 \overline{)\,1\,2\,0\,2\,4\,1\,}(.03$$

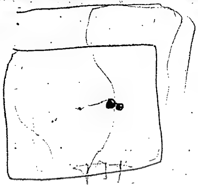

Pivot











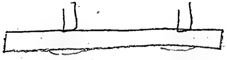
8 | 400,000 000
50,0000

100 000.

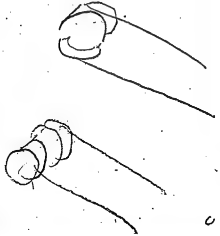
4

1

40



5



o | o

Menlo Park Notebook #161 [N-81-10-18] (NOT FILMED)

This notebook covers the period October 1881-January 1882. It contains what appears to be an inventory of fibers used for the production of carbon filament lamps at the lamp factory. There are also records of other supplies used for the production of lamps. The label on the front cover is marked "Alex Welsh." The book contains 284 numbered pages. Approximately 15 percent of the pages have been used.

Menlo Park Notebook #165 [N-81-00-01]

This notebook is undated but was probably used in 1880. The entries are by Francis Upton and William J. Hammer. Included are notes, calculations, and tables relating to conductors needed for the Pearl Street central station. There are also a few drawings of electric power distribution systems. The label on the front cover is marked "Hammer," "Upton," and "Line Figureing for Station." The book contains 284 numbered pages.

Blank pages not filmed: 234-283.

Square No. 1 Black

2/270
135 Lights

2/1199
599 600 feet

.0049
135
.0245
.147
.49
.6615

11.2
135
560
336
112
1512.0

1530 ft

10/270
27 Lights

.0124
.27
.868
.248
.3338
cross section

145.
27
1015
290
3915 weight

1320 ft

10/270
27 Lights

361000

.0106
27
742
212
.2862
c.s.

108.9
27
7623
2178
2940.3 weight

2

1092
546.

2 | 333 Lights
166.5

.0044
166.5
220
264
264
44
.7x3260

9.11
166.5
45555
5466
5466
911
1516.815

1840 +

10 | 333
33.3

.0108
33.3
324
324
324
.35964

112.2
33.3
3366
3366
3366
373626

1204.2 -

10 | 333
33.3

.0097
33.3
291
291
291
.32301

90.
33.3
2997.0

3

1141
570

2 | 300 Lights
150

.0045
150
02250
45
.6750

9.8
150
490.0
98
1470.0 lbs

1170 +

10 | 300
30 Lights.

.0094
30
.2820

85.6
30
2568.0

1030 -

10 | 300
30 Lights.

.0083
30
.2490

66.
30
1980.

1090
545

2 | 340
170

.0044
170
3080
44
.7480

9.11
170
63770
911
1548.70

1000 +
13 | 340
34 Lights

.0081
34
.2754

62.5
34
2500
1875
21250

920 —
10 | 340
34

.0074
34
296
222
0.2516

52.9
34
2116
1587
1798.6

1266
633

400
200 Lights

.0052
200
1.0400

12.8
200
2560

860 +
10 | 400
40 Lights

.0069
40
.2760

46.2
40
1848.0

990 —
10 | 400
40

.0080
40
.0320

61.5
40
2460.0

1987
493 feet

2/250 Lights
125

125
.0041
125
500
.51250

125
7.81
125
1000
875
976.25 lb

1050 +

10/250 Lights
25

.0085
25
425
170
.2125

68.9
25
3445
1378
1722.5

1870 −

10/250
25

.0070
25
.1750

47.3
25
236.5
946
1182.5

2/894
447 feet

2/160 Lights
80

Service

.0036 sq.in
80
0.2880 sq.in

6.050 lb
80
484.000 lb

740 +

10/160
16

.0060
16
.0960

34.2
16
205.2
342
547.2

690 −

10/160
16

.0056
16
.0896

29.7
16
1782
297
475.2

2 | 1027
513.5

2 | 220 Lights
110

.0042
110
.0420

8.45
110
929.50

1500 +

10 | 220
22 Lights

.0121
22
242
242
.2662

140.6
.22
2812
2812
3093.2

1210 -

10 | 220
22 Lights

.0098
.22
196
196
.2156

91.5
.22
1830
1830
2013.0

2 | 1238
619

2 | 1460 Lights
230

.0050
230
1500
100
1.1500

120
230
27600.0

1250. +

10 | 460
46 Lights

.0101
46
.4646

97.6
46
5856
3804
4389.6

1410 -

10 | 460
46 Lights

.0114
46
684
456
.5244

124.2
.46
7452
4968
4713.2

2 | 1059
529.5

2 | 230
115 Lights

.0042 × 115 = .4830

8.45 × 115 = 971.75

1430 +

10 | 230
23

.0118 × 23 = .2714

133.2 × 23 = 2063.6

1620 −

10 | 230
23

.0131 × 23 = .3013

164 × 23 = 3772

2 | 1400
700

2 | 370
185 Lights

.0057 × 185 = 1.0545

15.3 × 185 = 2830.5

1190 +

10 | 370
37 Lights

.0096 × 37 = .3552

88.4 × 37 = 3270.8

1090 −

10 | 370
37 Lights

.0088 × 37 = .3256

742 × 37 = 27454

2) 360 Lights
180

2) 1282
641

.0052
.180
4160
52
.9360

12.8
.180
10240
128
2304.0

900 + .0079 .36 2844

10.360 36

60. 36 2160

880 – .0071 .36 .2556

10.360 36 Lights

48.4
.36
2904
1452
174.24

2) 320 Lights
160

2) 1283
641.5
320
961

.0052
160
3120
52
.8320

12.8
160
7680
128
1048.0

840 + 101.320 32

.0068
32
.2176

44.
32
1437

420. – 101.320 32

.0034
32
.1088

11.0
32
.352.0

2 | 150 Lights
25

2 | 452
226.

.0018 × 25 = 90, 36, .0450

8.025 × 25 = 15125, 6050, 75.625

6 200 — 10 | 150, 25

1.250 × 5 = 1.6250

24.0 × 5 = 12.0

600 — 10 | 150, 5

.0051 × 5 = .0255

24.8 × 5 = 124.0

2 | 320 Lights
160

2 | 924
462

.0037 × 160 = 02220, 37, .5920

6.612 × 160 = 396720, 6612, 1057.920

490 + — 10 | 320, 32

.0039 × 32 = 78, 117, .1248

15 × 32 = 1880.

230 — 10 | 320, 32

.0018 × 32 = .0576

3.306 × 32 = 6612, 9918, 105.792

2/110 Lights
53

2/760
380

.0031 × 55 = 155, 155, .1705

4.512 × 55 = 22560, 22560, 248.160

500 +

10/110
11 Lights

.0040 × 11 = .0440

15.6 × 11 = 172.6

270 -

10/110
11

.0022 × 11 = .0232

4.55 × 11 = 60.05

2/280 Lights
140

2/1247
623.5

.0050 × 140 = .7000

12.0 × 140 = 1680.0

630 +

10/280
28

.0052 × 28 = .1456

26.4 × 28 = 2112, 528, 739.2

430 -

10/280
28 Lights

.0033 × 28 = .0900

115.5 × 28 = 9240, 2310, 323.40

2 | 80 lights
40

2 | 788
394

.0031
40
.1240

4.512
40
180.480

800 +

.0065

920 –

.0074

529

.0592

4232

2 | 210 lights
105

2 | 867
433.5

.0036
105
.0180
36
.3780

6.050
105
30250
6050
635.250

960 +

10 | 210
21

.0078
21
.1638

57.6
21
576
1152
1209.6

1070 –

10 | 210
21

.0086
21
86
172
.1806

71.1
21
711
1422
1493.1

2/220 Lights
110

2/1041
520.5

.0042 × 110 = .4620

8.45 × 110 = 929.50

1120 +

22

22

1750

784 × 22

1724

1230 -

10/220
22

.2156

94.6 × 22

1892

1892

2081.2

2/260 Lights
130

2/1030
515

.0042 × 130

1260
42
.5460

8.45 × 130

2535 0
845
1098.50

290 +

10/260
26

.0023 × 26 = .0598

5.25 × 26

3150
1050
136.50

300 -

10/260
26

.0024 × 26 = .0624

5.6 × 26 = 145.6

2|140 Lights
70

2|951
475.5

.0139
70
.2730

7.2
70
504.0

10|140
14

10|140
14

2|1175
587.5

2|260 Lights
130

.0047
130
1410
47
.6110

10.5
130
3150
105
1365.0

180+

10|260
26

.0014
26
84
28
.0364

202.5
26
12150
4050
42650

560−

10|260
26

.0045
26
.1170

19.6
26
1176
392
509.6

2|300 Lights
150

2|1129
564.5

.0045
150
.6750

9.8
150
1470.0

10|300
30 Lights

.0050
30
.1500

30

.470 —

10|300
30 Lights

.0070
30
.2100

47.3
30
1419.0

2|450
225

2|1413
706.5

.0057
225
285
114
114
1.2825

15.3
225
765
306
306
3442.5

.750 +

10|450
45 Lights

.0075
45
375
300
.3375

54
45
2430.

1.010 —

10|450
45 Lights

.0100
45
.4500

96.1
45
4805
3844
4324.5

2 | 290 Lights.
145

2 | 1054
527

.0042
145
210
168
42
.6090

8.45
145
4225
3380
845
1225.25

200 +

10 | 290
29

.0016
29
.0464

25.00
29
[illegible]500
[illegible]
[illegible].500

870 −

10 | 290
29

.0[illegible]21
29
[illegible]7
[illegible]1
.05[illegible]

9.5
29
855
190
275.5

2 | 210 Lights.
105

2 | 880
440

.0041
105
205
41
.4305

6.050
~~7812~~
103
39660
7812
820.260

6.050
105
30250
6050
635.250

520 +

10 | 210
21

.0042
21
.0882

16.9
21
169
338
354.9

690 −

10 | 210
21

.0056
21
.1176

29.7
21
297
594
623.7

2 | 260 / 130 Lights

2 | 1039 / 519.5

.0042 × 130 = 1260 + 42 = .5460

8.45 × 130 = 25350 + 845 = 1098.50

43.05 × 26 = 1119.31

10 | 260 / 26

.049

1695.6

2 | 155 / 77.5 Lights.

2 | 712 / 356

.0029 × 77.5 = 145 + 203 + 203 = .22475

4.05 × 77.5 = 2025 + 2835 + 2835 = 313.875

10 | 155 / 15.5

.0085 × 15.5 = 425 + 425 + 85 = .13175

35.9

850

10 | 155 / 15.5

.0071 × 15.5 = 355 + 355 + 71 = .11005

750.2

2/320 160 Lights

2/896 448

.0036
160
.5760

6.05
160
968.00

2/160 80 Lights

2/690 345

.0028
80
.2240

3.612
80
288.960

580 +

10/165 16

.0047
16
[illegible]
.0752

21.0
16
[illegible]
336.0

500 -

10/160 16

.0040
16
.0640

15.6
16
936
156
249.6

2/160
80 Lights.

2/923
461.5

.0037	6.612
80	80
.2960	528.960

4704

.0036	13.8
15	15

16

16	12.1
	16

2/150
75 Lights.

2/849
424.5

.0034	5.512
75	75
.2550	27560
	38584
	413.400

3604

15 Lights

.0029	8.1
15	15
.0435	405
	81
	121.5

610 — 15 Lights.

.0049	23.2
15	15
.0735	1160
	232
	348.0

2|830
415

2|150
75 Lights.

.0034
75
.2550

5.512
75
27560
38584
413.400

---

710 -

10|150
[illegible]

[illegible]
15
.[illegible]855

[illegible]
15
[illegible]15
15
[illegible]

---

920 -

15 Lights

.[illegible]
15
[illegible]
.11[illegible]

[illegible]
[illegible]
793.5

2|240
120 Lights.

2|1033
516.5

.0042
120
.5040

8.45
120
1014.00

---

960 -

2|240
24 [illegible]

.0078
24
312
156
.1872

57.6
24
304
1152
1382.4

1280 -

24 Lights.

.0103
24
412
206
.2472

1024
[illegible]
[illegible]
[illegible]
24576

$2/\overline{734}$
367

$2/\overline{180}$ 90 Lights

.0029, 4.05
90 90
.2610 364.50

.08
1
.19

1C

.272
7.84
1411.2

$/\overline{461}$
230.5

$2/\overline{90}$ 45 Lights

.0019 1.800
45 45
.0955 81.000

1100+

$10/\overline{90}$ 9 Lights

.59
.9
.61

75.6
9
680.4

1940.

$10/\overline{90}$ 9

.0084
9
.0756

67.6
9
608.4

$2\underline{)160}$
80

$2\underline{)617}$
308.5

.0024	2.812
80	80
.1920	224.960

1020 + 10/160 16 Eight

.129

65.1
16.
206
751
1041.6

16.

.1136

2904
484

$2\underline{)90}$
45

$2\underline{)519}$
259.5

.0021	2.112
45	45
.0945	10560
	8448
	95.040

820 + 10/90 9

9 · .0604
42. 9 378

640. – 9 Eight

.0052	.256
9.	9
.0468	230.4

2|765
382.5

2|90 Lights
45

.0031
45
.1395

4.512
45
22560
18048
203.040

2|780
390

2|150 Lights.
75.

.0031
75
.2325

4.512
75
22560
31584
338.400

790-

.0960

585.

2/120
60 Lights

2/710
355

.0029   4.050
60   60
.1740   243.000

10/120
12
007. [illegible]

[illegible]

[illegible]

12   11.1
[illegible]   12
    65[illegible].2

2/921
460.5

2/180
90 Lights

.0037   6.612
90   90
.3330.   595,08.0

1130 [illegible]

.0071   [illegible]
.18   12
72.8   [illegible]
71   [illegible]
.[illegible]   1434.8

1430.   18 Lights

.0115   127.3
18   18
.0920   10184
115   1273
.2070   2291.4

2/864.
432.

2/220 Lights
110

.0036
110
.3960

6.050
110
665.500

2/90 Lights
45

2/592
296

.0024
45
.1080

2.812
45
14060
11248
126.540

1320+

12/90
9 Lights

1260 -

9 Lights

.0102
9
.0918

99.2
9
892.8

2|727
363.5

2|120
60 Lights

.0029 × 60 = .1740

4.050 × 60 = 243.000

[illegible] +

10|120
12 Lights.

.0[illegible] × 12 = .[illegible]

[illegible] × 12 = 11532

11[illegible] -

12 Lights.

[illegible] × 1[illegible] = .[illegible]

[illegible] × 12 = .[illegible]1.8

2|595
297.5

2|80
40 Lights.

.0024 × 40 = .0960

2.812 × 40 = 112480

[illegible] +

[illegible] 80
8 Lights

×

.0084 × 8 = ~~.0[illegible]~~ .0672

67.6 × 8 = 540.8

---

990 -

8 Lights

.0080 × 8 = .0640

61.5 × 8 = 492.0

2/230
125 Lights

2/876
438

```
 .0036        6.050
  125          125
 ----         -----
  180         30250
  72         12100
 36          6050
 ----        --------
 .4500       756.250
```

1100 +

[illegible] Lights.

[illegible]

.[illegible]67 [illegible]

[illegible]

220 —

23[illegible]

```
 .0074       [illegible]
  23
 ----
 [illegible]    [illegible]
               [illegible]
               1?1?.7
```


2/200
100 Lights

2/797
398.5

```
 .0032        5.
   100        100
 -----       -----
 .3200        500.
```

79[illegible] +

10/200
20 Lights

```
 .0064
 [illegible]
 -----
 .128[illegible]     78[illegible]
```

1?4 —

20 Lights

```
 .0084         67.5
    20         [illegible]
 -----        -------
 .1680        1350.0
```

2/872
436

2/150
75

.0036
75
.2700

6.050
75
30250
42350
453.750

1180+

2/1350
15 [illegible]

.0095
15
.1425

87
15
1305

1370−

15 [illegible]

.0111
15
555
111
.1665

117.3
15
5865
1173
1759.5

2/911
450.5

2/140
70

.0037
70
.2590

6.612
70
462.840

1440+

10/140
14 [illegible]

.0116
14
464
116
.1624

129.6
14
5184
1296
1814.4

1690−

14 [illegible]

.0137
14
548
137
.1918

178.5
14
7140
1785
2499.0

No · No wire

1

2

No of Block	No of Lamps	Length of Distributing Wire	Cross section of Dist. Wire	Weight in lbs of Dist. Wire	Length of the "x" main Wire	Cross section of "x" main wire	Weight of "x" main wire	Length of "1" main wire	Cross section of "1" main wire	Weight of "1" main wire
1	270	1199	.6615	1512.	1530	.3338	3915.	1320.	.2862	2940.3
2	333	1092	7x326	1516.81	1340.	.35964	3730.26	1204.2	.22301	2997.0
3	300	1143	.6750	1470.	1170.	.2820	2568.	1030.	.2490	1980.
4	340	1090	.7480	1548.7	1000.	.2754	2125.	920	.2516	1798.6
5	400	1266	1.040	2560.0	860.	.2760	1848.	990.	.0320	2460.
6	250	987	.5125	976.25	1050.	.2125	1722.5	1870	.1750	1182.5
7	160	894	.2880	484.0	740.	.0960	547.2	690.	.0896	475.2
8	220	1027	.2420	929.5	1500.	.2662	3093.2	1210.	.2156	2013.
9	460	1238	1.150	2760.0	1250.	.4646	4389.6	1410.	.5244	4713.2
10	230	1059	.4830	971.75	1460.	.2714	2063.4	1620	.3013	3772
11	370	1400.	1.0545	2830.5	1191.	.3552	3270.8	1090.	.3156	2745.4
12	360	1282	.9360	2304.	980.	.2844	2160.	880.	.2556	1742.2
13	320	1283	.8320	1048.	540.	.2176	1408.	420	.1088	352.0
14	50	452	.0450	75.15	620.	.0250	120.	630.	.0255	124.
185	4063		15.7935	20966.685	15530	3.71974	37891.96	15284.2	3.06221	29293.6

No of Block	No of Lamps	Length of Distributing Wire	Cross Section of Dist. Wire	Weight of Distributing Wire	Length of the "+" main wire	Cross Section "+" main wire	Weight of "+" main wire	Length of "−" main wire	Cross Section "−" main wire	Weight of "−" main wire		
15	320	924	.5920	1057.92	490	.1248	1880	230.	.0576	1057.92		
16	110	760	.1705	248.16	500	.0440	172.6	270.	.0232	60.05		
17	280	1247	.7000	1680.	650	.1456	739.2	430.	.0900	323.4		
18	80	788	.1240	180.48	800	.0520	320.	920.	.0592	336.		
19	210	867	.3780	635.25	960	.1638	1209.6	1070.	.1806	1493.1		
20	220	1041	.4620	929.50	1120	.1980	1724.8	1230.	.2156	2081.2		
21	260	1031	.5460	1098.5	290	.0598	1365	300.	.0724	1451.6		
22	140	951	.2730	504.			V					central station block
23	260	1175	.6110	1365.	180	.0364	4265.	560.	.1170	509.6		
24	300	1129	.6750	1470.	620	.1500	720.	870.	.2100	1419.		
25	450	1413	1.2825	3442.5	930	.3375	2430.	1240	.4500	4324.5		
26	290	1054	.6090	1225.25	200	.5464	725.00	390	.0589	275.5		
27	210	880	.4305	635.25	520	.0882	354.0	690.	.1176	623.7		
273	3130		6.6535	14570.81	7260	1.1465	9810.25	8200	1.1840	11578.442		

No of Block.	No of Lamp	Length of Distributing Wire	Cross Section of Dist: Wire	Weight of Dist: Wire	Length of the "+" main Wire	Cross Section "+" main Wire	Weight of "+" main Wire	Length of "−" main Wire	Cross Section of "−" main Wire	Weight of "−" main Wire		
28	260	1039	.5460	1098.5	830.	.1742	1119.3	1020	.2132	1695.2		
29	155	712	.22475	313.875	1050.	.13175	1067.95	880	.11005	750.2		
30	320	896	.576	96.80	860.	.2208	1478.4	640	.1664	819.2		793.5
31	160	696	.224	288.96	580.	.0752	336.	500	.0640	249.6		521.9
32	160	923	.2960	528.96	470.	.0608	.2208	440	.0560	193.6		1406
33	150	849	.2550	413.40	360.	.0435	121.5	610	.0735	348.		
34	150	830	.2550	413.40	710.	.0855	472.5	920	.1110	793.5		
35	240	1033	.5040	1014.	960.	.1872	1382.4	1280	.2472	2457.6		
36	180	734	.2610	364.5	1310.	.1908	1935.0	1120	.1620	1411.2		
37	90	461	.0955	81.	1100.	.0801	680.4	1040	.0756	608.4		
38	160	617	.1920	224.96	1020.	.1296	1041.6	880	.1136	774.4		
39	90	514	.0945	95.04	820.	.0604	378.	640	.0468	230.4	4	
402.	2115		3.52875	4933.295	10070.	1.43985	10233.55	9970.	1.33575	10331.3		

No of Block	No of Lamp	Length of Distributing Wire	Cross section of Distributing Wire	Weight of Dist. Wire	Length of "+" main Wire	Cross Section "+" main Wire	Weight of "+" main Wire	Length of "–" main Wire	Cross Section "–" main Wire	Weight of "–" main Wire
40	90	765	.1395	203.04	720	.0522	291.6	550	.0396	170.1
41	150	780	.2325	338.4	570	.0690	304.5	790	.0960	585
42	120	710	.1740	243.	960	.0936	691.2	1070	.1032	853.2
43	180	921	.3330	595.08	1130	.1638	1434.6	1430	.2070	2291.4
44	220	864	.3960	665.5	1530	.2728	3212	1340	.2376	2468.4
45	90	592	.1080	126.54	1320	.0954	980.1	1260	.0918	892.8
46	120	727	.1740	243.	1240	.1200	1153.2	1120	.1080	940.8
47	80	595	.0960	112.48	1040	.0672	540.8	990	.0640	492.0
48	230	876	.4500	726.25	1100	.2067	1738.8	920	.1702	1216.7
49	200	797	.3200	500.	790	.1280	780	1040	.1680	1352
50	150	872	.2700	453.75	1180	.1425	1305	1370	.1665	1757.5
51	140	911	.2590	462.84	1440	.1624	1814.4	1690	.1918	2499.
546	1776		2.9520	1667.88	13020	1.5736 (over)	14362.2	13570	1.6437	15530.9 (over)

11078 Lamps

Cross section of Dist. wire
29.12275

Weight of Dist. Wire
48950.005

Length of + main wire
45880

Cross section of + main
8.18609

Weight of + main
75287.21

Length of – main
47024.2

Cross section
7.66976

Weight
63363.342

Total no of Lamps — 11078.
Length of Distributing Wires — —
Cross Section of " " — 29.12275
Weight of " " — 48950.005
Length of "+" main wires — 45880.
Cross Section of "+" main wires — 8,18609
Weight of "+" main wires — 75287.21
Length of "−" main wires — 47024.2
Cross Section of "−" main wires — 7.66976
Weight of "−" main wires. 66363.342

75
.63
49
187000
6

1.4)157000
.13

23
24
47

1092
386
1478
20
1498

73 26
36.6

28
14
33.5

28
13
41

49 35
28 28
77 63

1141
399
1540

Both | Crossing of Pipe

1

1199
599
1798

2 | 6615
.3307

D	24	Wires	1798 feet
D&M	47	Wires	410 feet
	44	wires	208 feet
	20	wires	20 feet
2	23	wires	20
	28	–	1498
	41	"	202
	77	"	157
	63	"	157
	35		203
	49		15
	35		15

3 1540

1. Feet Cross Section No. Wires

100 Ohm 200 Ohm

1798

2.

3.

214
194
220
196
———
1?2.4
?112

5.25
5
———
26.25

5) 12.4
2.5
———
15, Volts

124
124
———
136.4 Volts

26.25
26.2
180
———
20960
262
———
47160

5) 12.4
2.48
———
14.88

For 120 Volts to start with 1/5 more Volts fall

5) 12.4
2.48
———
14.88 Volts

24

30 Lamps at equal distances 60' along a conductor each having 10 Ohms in the conductor will have a fall of E.M.F from 100 to 87.6 Volts. The conductor will weigh 440.7 lbs.

12.4 Volts
87.6
———
100.0

10 Lamps will have the same fall and conductors will weigh $\frac{440.7}{3}$ = 146.9 lbs.

See page 77

366
198
10
208

1320
208
1112

To square No. 1

2/370
185
22.5
29
235
471 5
10
264
62
87
26
920 5
10
137
34.7
139
29.3
1267.5 feet

1267 feet

~~100~~
270 lamps

200 lbs for 10
27
200
5400 lbs Cu

3915
2940
6855 in mains of ott
5400
1455
1512 in distribution
2967 lbs
1483

6855
1512
270) 8367 (30 lbs per lamp
810
67

6,1336
2,7589
2,7589
18 1.2553
2,9067 807 lbs
~~1614~~
538 lbs

188
386
~~577~~ feet

40.7 for 10 lamps
.15
2035
407
610.5 for 10 lamps

2.4 volts
25
39
14 volts fall

1483 : 610.5 :: 14 :

188
386
574

2.7589
2
5.5178

9.83

3.2553
2
6.5106
5.5178
.9928

440.7 lbs Cu

$1800^2 : \cancel{574}\ a^2 :: 440.7 : X$

comp 1800^2 3.4894
log 440.7 2.6442 6.1336
log a^2 5.5172
1,6508 44.7 lbs

Square 1

14.88	1.1726
146.9	2.1670
comp 1800	6.7447
1800	6.7447
	6.8290 - 70

5.6564

a^2	2.7589
	2.7589
b	1.4314
comp c	6.5280
	.3062

2 Volts

1.1726
1.13496
.0378

6.8290
.0378
6.7912

a = 574
b = 120 + 150 = 270
c = 2967.

From page 71

Let a = distance furthest lamp is away
b = no lamps ÷ 10
c = amount of copper at hand
X = fall E. M. F.
d = amount to 10 lamps by Table 10 Ohms to lamps

$1800^2 : a^2 :: 146.9 : d$

$$\frac{\frac{14.88}{c}}{bd} = X$$

$$\frac{14.88\, bd}{c} = X \qquad d = \frac{146.9 a^2}{1800^2}$$

$$\frac{14.88 \times 146.9 b a^2}{1800^2 c} = X$$

13.64 Volts in place 14.88 to represent fall from 110 Volts

a 29.3
10
385
20
1.43
5873

C 190 lamps on one side
1267 feet
19
200
3800 lbs Cu.

140
200
28000
3800
6600

3736
2997
6733

.133
1517
1640

D 1517
\+ 3736
— 2997

333) 8250 (25 lbs Cu to lamp
666
1590
1332

6.8290
587 2.7686
587 2.7686
19 1.2788
1640 3.7852
.4302
190 7.7212
330 2.5185
.6699

486 6.8290
2.6866
2.6866
1.1461
7.0936
.4421
2.76 .3378
2.56 .4083
4.66 Volts

Square 3

1470
2568
1980
6018 Obs

300 Camps:

105
30
3150

6018
3150
4868 Obs

10
137
20
394

 From pages 76 & 77

13.64

1.1348
5.5564
6.7912
2.6866
2.6866
1.1461
.7.0894
6.3999

b = 18
a = 486
c = 806

Square d

2.49+

0.7370
2.1670
6.7447
6.7447
6.3934

5.6564
.7369
6.3933

5.456

.0002473

1.

.2.5 Volts can be lost
in wires leading from main distributing

13.64
2.5
5.456

From page 77

Let y = amount Cu required to give fall of 2.5 Volts
No. lamps = b
Furthest lamps a feet away.

$1800^2 : a^2 :: 146.9 : d$

$5.456 d b = y$

$$\frac{5.456 \times 146.9 a^2 b}{1800^2} = y$$

$.0002473\ a^2 b = y$

Square 1

10
386
20
188
604 feet = a

b = 15

6.3933 − 10
2.7810
2.7810
1.1761
3.1314

1350 lbs

10
195
20
390
615

b = 12
15

6.3933
2.7889
2.7889
1.0792
3.0503

1120
24.70

Square 2 #

10
385
20
71

√ 486

14

(143
71.5

6.3933
2.6866
2.6866
1.1461

2.9126

818

10
387
20
72

√ 489 15

6.3933
2.6893
2.6893
1.1761

2.9486

88.7

1705

Square 3

10
394
20
90
514
140

6.3933
2.7110
2.7110
2.1461
2.9614

916

10
390
20
90
510
12

6.3933
2.7076
2.7076
1.0792
2.8877

77.3
1689.6

Block 4

395
20
190
20
405

1020
510

6.3933
2.7076
2.7076
1.1461

14 2.9546

1.8085
901.

1.8085
1.2304

17 3.0389

1090
1991

Block 5

10
384
20
178
20
400
10.

1022
511

6.3933
2.7084
2.7084 1.8101
16 1.2041
3.0742 1030

1
1.8101
14 .1464
2.9562 904
1934

Block 6

198
267
465.
5
470
30

10
493
20
523

6.3933
2.7185
2.7185
20. 1.3010
3.1313

1350

Block 6 & 7

10
16.2
25
190
387

6.3933
2.5877
2.5877
9 0954 2
2.5229

333
1683

Block 8

10
380
20
119
~~20~~
√529

19

6.3933
2.7235
2.7235
1.2788
3.1191

1310

Block 9

Both sides

10
376
20
296
20
341
10
1073
√536

150
120
100
370

6.3933
2.7292
2.7292
37. 1.5682
3.4199 2620

Block 10

Both sides

10
338
20
188
20
300 ~~18~~
20 23
193
10

1099

549

6.3933
2.7396
2.7396
1.2553

3.1278 1340

Block 11

20		
193		6.3933
20	4.0	2.6712
487	15.0	2.6712
20	.40	
188	23.0	1.3617
10		3.1074 1280

2 | 938

1469

Block 12

20
494
10
1524 28
530
1054
527
263

6.3933
2.4200
2.4200
1.4472
2.6805

399

140
20
20
180 4
90

6.3933
1.9542
1.9542
0.6021
.9038

81
480

Block 13

2)399
199
81

Sop block

498
200
298
17
315

6.3933
2.4983
2.4983
7.21 0.8573
2-2472

175
455

Block 14

30
10
70
20
180
162
~~25~~
472
236

6.3933
2.3729
2.3729
5. 9.6990
2.8381

69 lbs

Block 15

29.4
243
14.2
286.6
143.3

6.3933
2.1593
2.1593
1
1.7119 54.5

14
264
29
307
153

6.3933
2.1847
2.1847
1
1.7827 61.

60 lamps.
200 feet

6.3933 20
2.3010
2.3010
0.7782
1.7735 60

134
30
30
194
97 4

6.3933
1.9868
1.9868
0.6021
.9690 9

20 4.5

Block 16

15		6.3933
242		2.1553
30	4	2.1553
		.6021
287		1-3560
143		

20

10
10
40

Block 17

30	6.3933	30 lbs
335	2.2945	
30	2.2945	
	11	
395	19823	96
197		

both sides

30	6.3933	
268	2.5378	
20	2.5378	
363		
10		
691	12 .10792	353
345	2.5481	479 lbs

Block 18

30
10
250
20
120
438

	6.3733
	2.6415
	2.6415
7	0 8451
	2.5214

332
20
352

Block 19

40	6.3933	
262	2.3579	
20	2.3579	
95	9 0.9542	
40		
457	2.0633	11.5
228		
	6.3933	
180	2.1139	
30	2.1139	
30	4. .6021	
20		
260	1.2232	20
130		
		70
		205

Square 20

40
1902
20
320
20
191
10
1763
381

6.3933
2.5809
2.5809
1.1161
14 2.6712

469

Square 21

10
234
20
142
6

10
224
20
247
20
142
663

.46
20
40
35
135

6.3933
2.8235
2.8235
1.1303
3,1706

1408 lb

Square 22

30

370	6.3933
20	2.2900
390	2.2900
195	1.0792
	2.0525

115

145

Square 23

108	6.3933
370	2.7160
20	2.7160
275	21 ~~7~~ 3222
20	3.1475
335	
10	
1040	
520	

1410

34
320
49
407

Square 24

24
16
286
20
215
20
370
20
218
1183
591

6.3933
2.7716
2.7716
30 1 4771
X3.4136

2590

Block 25

10	6.3933
282	2.7177
20	2.7177
428	30 1.4771
20	
285	3.3058
110 45	
522	

2020

Block 26

10	6.3933	
320	2.6444	
20	2.6444	
204	1.3802	
20	24 3.0623	.1150
297		
10		
881		
441		

Block 27

10	6.3933
198	2.5302
20	2.5302
218	1.1761
20	2.6298
202	
10	
678	
33.9	

15

426

Block - 28

10
285
20
188
20
331
10

864

432

21,

6,3933
2,6355
2,6355
1,3222

2,9865

970

Block 29

10		6.3933	
179		2.4502	
20		2.4502	
138	13	1.1139	277
20		2.4176	
187			
70			
564			
282			

Block 30

30
21.3
10
125.3
125

6.3933
2.0969
2.0969
8 0.9031
1.490.2

31.0
50
35
116

Block 31

10
232
20
88
20
246
20
84
20

$\boxed{740}$

370

6.3933
2.5682
2,5682
1,2041

2.7338

542

Block 32

249
20
240
20
227
20
176
20

972
486

6.3933
2.6866
2.6866
16 1.2041.
2.9706

935.

Block 33

10
287
20
97
020
270
20
$\boxed{724}$
362

6.3933
2.5587
2.5587
12 1.079 /2
2.5899

390

Block 34

10		6.3933
193		2.6385
20		2.6385
219	.14	1.1461
20		2.8164
167		
20		
211		
10		
8.70		
435		

655 lb.

Block 35

10	6.3933	
3,0	2.6464	
20	2.6464	
186	20 1.3010	
20	2.9871	971.
330		
10		
886		
443		

Block 36

10	6,3933	
188	2,4757	
20	2,4757	
158	13 1,1139	
20	2,4586	287
192		
10		
598		
299		

Block 37

108

Block 38

100

Block 39

quess 30

Block 40

10		6.3933
177		2.6053
20		2.6053
196	6.	0.7782
403		2.3821

241

Block 41

10	6.3933
215	2.3118
20	2.3118
154	7 0.8451
10	1.8620
413	
205	

73

Block 42

10	6.3933
194	2.2714
20	2.2718
141	~~69 0.9542~~
10	~~11.8907~~
375	
187	

~~80~~

60

Block ~~Q~~ 44

32
10
194
20
214
20
196
20
220
10

936

468

6.3933
2.6702
2.6702
22 1.3426

3.0761 1200

Block 43

10		6.3933
310		2.6464
20		2.6464
186	20	1.3010
20		
330		2.9871
10		
$\boxed{88.6}$		
443		

Block 35

971

10	~~2.5966~~
2??	2.5977
??	2.5977
1??	1.1761
20	.63983
296	
10	
$\boxed{702}$	2.7648
	.0666
276	.8312

582 678

Block 45

42	6.3933	20
222	2.2253	
20	2.2253	
52	5 0.6990	
336	1.5429	
168	4 0.6021	140
	2.1450	160

Block 46

5 2
22 7
2 0
114
413

6.3933
2.6160
2.6160
9 09542
2.5795

5-u

380
430

Block 47

52	6.3933	20
230	2.4983	
20	2.4983	
43	7 0.8451	172
313	2.2350	192

Block 48

10	6.3933	
240	2.6117	50
20	2.6119	
179	19 1.2788	
409	2.8955	785

Block 49

10
244
20
115
20
250
20
148
10

837

418

6.3933
2.6212
2.6212
20 1.3010

2.9367

864

Block 5-D

100

Block 51

40
160
20
246
20
156
20
285
10
1981
490

6.3933
2.6902
2.6902
14 1 1461
2.9198

831

40.890
81.306
122196

187000
122196
64804 for equalizing

40890 4.6116
1.15 0.0629
4.6745

47.200 with straight wires
mains 81.366 between the
128.506 lbs.

187,000
128.506
58.500

2470	2590
1701	2020
1689	1150
1991	426
1934	970
1683	277
1310	116
2620	542
1340	935
1280	390
480	655
455	971
69	287
204	100
40	100
479	30
352	241
205	73
469	60
1408	1200
145	971
1410	160
23534	436
17366	192
40890	785
	864
	100
	831
	17366

6

6

7

1.1349
2.1671
9.2392
2.5412   347.7

405   2.6075   53
347.7   2.5412   45
1.165   .0663   18

Amount Cu to be multiplied by 1.165 to give amount wit straight wires

1000 feet out
2000 " in total ~~gives~~ Takes
125 lbs of Cu to
make one Ohm

10 lamps at equal distances along this will ~~take~~ have a fall of 5.24 Volts in 100 or 5.764 Volts in 110

1800 feet out will take 405 lbs. of Cu.
10 lamp along decreasing conductor will take
146.9 lbs and have 13.64 Volts fall

5.764 : 13.64 :: 146.9 : 347.7
347.7 lbs to have a fall of 5.764 Volts from 10 lamps along decreasing conductor 1800 feet long.

7.1 lbs both wire
3.55 each wire

1674
937
1602
974
1347
1694
8228 feet
2

0.5502
$\bar{2}$.7354
1.8148

65 wires

58 500 lbs

58.500 4.7672
8,228 3.9151
.8521
7.1 lbs per foot

No 10 wire
lbs 94.6 1.9759
feet 1740 3.2405
$\bar{2}$.7354
.0544 lbs per foot

Length of equalizing mains

29	30	2)285 / 142	2)498 / 249
137	492	10	
34	39	35	1162
137	166	234	556
36	42	26	602
89	156	249	10
61	10	20	157
264	937	115	32
44		35	546
328		108	1347
54		974	
110	556		155
64	600		47
20	157		167
188	199		41
40	70		195
39	20		42
1674	1602		378
			49
			298
			46
			222
			53
			1694

1162
556
546

To find point of greatest economy to run wires to

a = distance AB one station

b = BC

Lamp at C takes
c^2 lbs of Cu

Lamp at b takes b^2

Let x = Bx where lamp is placed

then

~~$(a+4x)^2$ = Cu~~

$a^2 + 4x^2$ = Cu it takes supplied from A

$(a+b)^2 + 4(b-x)^2$ = Cu it takes supplied from C

$a^2+4x^2 = b^2+4(b-x)^2$

$= b^2+4b^2-8bx+\cancel{4x^2}$

$8bx = b^2-a^2+4b^2$

$x = \dfrac{5b^2-a^2+\cancel{4b^2}}{8b}$

$a+b = 1267$

$a = 920$

$b = 347$

$2.5403 \times 2 = 5.0806$

$2.9634 \times 2 = 5.9276$

$b^2 = 122000$

$a^2 = 846000$

$\ 610000$

$\ 236000$

$122000 \times 5 = 610000$

$347 \times 8 = 2776$

2788

5.3729

3.4452

1.9277

85 feet

$a^2+4x^2+b^2+4(b-x)^2$ must be a minimum

$8x-8b+8x = 0$

$b^2-2bx+x^2$

~~$16x = 8b$~~

~~$x = \frac{4}{10}b = \frac{4}{5}b$~~

$16x = 8b$

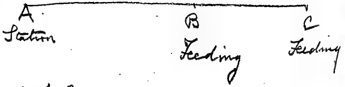
$x = \frac{1}{2}b$

$a^2+5x^2+b^2+5(b-x^2)$

$10x^2-10b+10x = 0$

$x = \frac{1}{2}b$

$a^2+4x^2=$



$AB = a$
$AC = c$
$BC = b$

~~[illegible]~~

$a^2+4x^2 = c^2+4(b-x)^2$

$a^2+\cancel{4x^2} = a^2+4b^2-8bx+\cancel{4x^2}$

$\cancel{8b}x = \dfrac{c^2+4b^2-a^2}{\cancel{8b}}$

$x = \dfrac{c^2+4b^2-a^2}{8b}$

$c = 1267 \quad c^2 = 1607000$
$a = 920 \quad a^2 = 846000$
$b = 347 \quad b^2 = 122000$

$\begin{array}{r} 122000 \\ 4 \\ \hline 488000 \end{array}$

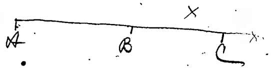
$\begin{array}{r} 1607000 \\ 488000 \\ \hline 2095000 \\ 846 \\ \hline 1.249000 \end{array}$

$\begin{array}{r} 3.1028 \\ 2 \\ \hline 6.2056 \end{array}$ 10...

$\begin{array}{r} 347 \\ 8 \\ \hline 2776 \end{array}$

$\begin{array}{r} 6.0966 \\ 3.4435 \\ \hline 2.6531 \end{array}$

$x = 450$
397



$AB = a = 2$
$BC = b = 3$
$AC = c = 5$

$a^2 + 4x^2 = c^2 + 4(b-x)^2$

$a^2 + \cancel{4x^2} = c^2 + 4b^2 - 8bx + \cancel{4x^2}$

$8bx = c^2 + 4b^2 - a^2$

$x = \dfrac{c^2 + 4b^2 - a^2}{8b}$

$\dfrac{25 + 36 - 4}{24} = \dfrac{57}{24}$

1.7559
1.3802
.3757 2.3

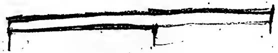
$a = 9$
$b = 3$
$c = 12$

144
36
180
81
99

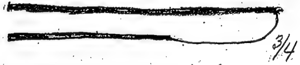
$x = \dfrac{99}{24} = 4\tfrac{1}{8}$

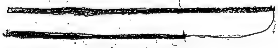
$a = 8$
$b = 3$
$c = 11$

121
36
157
64
$\dfrac{93}{24}$



If the cable runs between two points there will be a fall of E. M. F due to the line being





137
20
157
7
157
1299
13 4.7

157
2
314

52
3.2
10
156
166.1

520 lamps

1314.7
166.1

3.1185
2.2204
.8981

7.9
1/4 Volts fall

2.5
1.25
3.75 Volts fall

264
16
10
284
2
568

9.8

284
7.1
284
1988
2016.4

130
30
100
40
10
100
410

410
0
9.8
41
98
392
401.8

2 Volts fall
4.5 Volts

765
1267

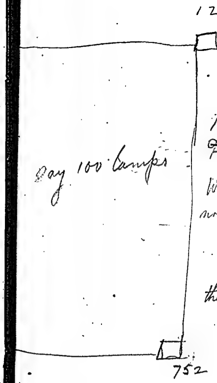
18
49

$$\begin{array}{r} 49 \\ 7 \\ \hline 343 \end{array}$$

$$\begin{array}{r} 18 \\ 78 \\ \hline 1268 \end{array}$$

Problem

$$\begin{array}{r} \cancel{1}3 \\ 193 \\ 20 \\ 487 \\ 20 \\ 188 \\ 13 \\ \hline 934 \end{array}$$



$$\begin{array}{r} 1000 \\ \cancel{934} \end{array}$$

What is the most economical point of division?

Say x feet from the 752 division then 1000 − x from 1207

$\frac{x}{10}$ lamps supplied from 752 — 70.5 lbs

$(100 - \frac{x}{10})$ lamps from 1207 — 182.

$\frac{x}{10 \times 10}$ 70.5 Cu. in main to 752

$(100 - \frac{x}{10})\frac{1}{10}$ 182 Cu. in main to 1207

$\frac{.0002473\, x^2 \frac{x}{10}}{10}$ = Cu in distributing from 752

$\frac{.0002473\,(1000-x)(100-\frac{x}{10})}{10}$ = Cu in dis- from 1207

$70.5 = na^2\, 7$ $.0002473 = 10\varepsilon$

$182. = 10b^2\, 7.$ $\varepsilon = .00002473$

$$\frac{x}{100}\,70.5 + \left(10 - \frac{x}{100}\right) 182$$

$$+ \frac{.00000\,2473\,x^3}{10} + \frac{.000\,2473\,(1000-x)^2}{10}\left(100 - \frac{x}{11}\right)$$

$=$ min

$.705x + 1820 - 1.82x$

$1000000 - 2000x + x^2$

$100000000 - 200000x + 100x^2$

$\cancel{1000}\ 100000x + 200x^2 - \frac{x^3}{10}$

$1000000000 - 3000000x + 3000x^2 + 11x^3$

$24736 - 74.1900000x + .07419x^2 - .00002473x^3$

$2473 - 7.419x + .007419x^2 - .0000002473x^3$

.0002473
300000
74.1900000
.07419

74.19
1.82
76.01
.705
75.305

7.419
1.82
9.239
.705
8.534

$(\ ) - 75.305x + .07419x^2 = $ min

$\frac{2}{14838}$

$.14838x = 75.305$

1.8768
1.1712
2.7056

.00002473
6
.00014838
.0014838

50.7 feet $= x$

$.014838x = 8.534$

$(1000-x)^3$

$1000000000 - 3000000x + 3000x^2 - x^3$

$\cancel{.00002473}$

.00002473 ~~1000~~

.000002473
1000000000
2473.000000

2473
3
7.419

.000002473
3000
.007419000

Try $x = 300$

$1000 - x = 700$

3.0
7.0

70.5
3
21 15 lbs.

6.3933
2.4771
2.4771
.4771
1.8346

211
68.3
279.3

182
7
1274 lbs.

2122
279.3
2401.3

6.3933
2.8451
2.8451
0.8451
2.9286

1274
848
2122

$x = 700$

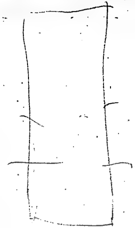
$1000 - x = 300$

7.
3.

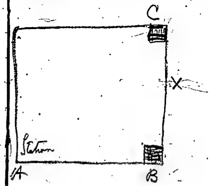
211
848
1159

1159
1342
2501

1274.
68.3
1342.3



Let $x = ?$



$AC = a$ n lamps

$AB = b$ Lamps $\frac{x}{c}\,n$ towards C

$CX = x$ $\frac{c-x}{c}\,n$ toward B

$CB = c$

$Bx = c - x$

Let F = Constant in mains

E = constant in distributing

$F =$
$E =$ Page 217

$$\frac{x}{c}\, n\, a^2 \mathcal{F} = \text{wt. main } AC$$

$$\frac{x}{c}\, n\, x^2 \mathcal{E} = \text{wt. distrib } Cx$$

$$\frac{c-x}{c}\, n\, b^2 \mathcal{F} = \text{wt. main } AB$$

$$\frac{c-x}{c}\, n\, (c-x)^2 \mathcal{E} = \text{wt. distributing } Bx$$

$$\frac{x}{c}\, n\, a^2 \mathcal{F} + \frac{x}{c}\, n\, x^2 \mathcal{E} + \frac{c-x}{c}\, n\, b^2 \mathcal{F} + \frac{c-x}{c}\, n\, (c-x)^2 \mathcal{E} =$$

$$= \frac{n a^2 \mathcal{F}}{c}\, x + \cancel{\frac{n\mathcal{E}}{c}\, x^3} + (n b^2 \mathcal{F}) - \frac{n b^2 \mathcal{F}}{c}\, x$$

$$+ \frac{c^2 - 2cx + x^2}{c}\, (c-x)\, n\, \mathcal{E}$$

$$\begin{array}{l} c^3 - 2c^2x + cx^2 \\ \quad - c^2x + 2cx^2 - x^3 \\ \hline (c^3 - 3c^2x + 3cx^2 - x^3)\ \dfrac{n\mathcal{E}}{c} \end{array}$$

$$+ n\mathcal{E}c^2 - 3cn\mathcal{E}x + 3n\mathcal{E}x^2 - \cancel{\frac{n\mathcal{E}}{c}\, x^3}$$

$$\frac{F}{6E} = \begin{array}{r} 5.0969 \\ 4.6067 \\ 9.2218 \\ \hline 8.9254 \end{array}$$ Decreasing

$$\frac{F}{6E} \quad \begin{array}{r} 5.0969-10 \\ 4.5403 \\ 9.2218-10 \\ \hline 8.8590-10 \end{array}$$ Same size

$$\begin{array}{r} 8.9254 \\ 8.8590 \\ \hline .0664 \end{array}$$

log $F = 5.0969$
log $E = 5.3933$ decreasing
$= 5.4597$ same size

$$(\quad) + \left(\frac{na^2F}{c} - \frac{nb^2F}{c} - 3cnE\right)x + 3nEx^2 = \text{min}$$

$$6nEx = \frac{nb^2F}{c} + 3cnE - \frac{na^2F}{c}$$

$$x = \frac{b^2F}{6cE} + \frac{c}{2} - \frac{a^2F}{6cE}$$

$$x = \frac{(b^2-a^2)F}{6Ec} + \frac{c}{2}$$

$$= \frac{(b-a)(b+a)F}{6Ec} + \frac{c}{2}$$

10 lamps
200 feet main
1 lamp 10000

$F = .0000125$ — 1.25 — 10 Volts for 1 lamp

Decreasing $E = .00002473$ — 2.5 Volts

Uniform Size $= .00002882$

J 5.9486
8.9254
4.8740
C = 9000 3.
1.8740 74.8

c − x = 574.6 feet

4.8740
C = 984 2.9930
1.8810

76

2|984
492
76
c − x = 568

a = 754
b = 1207
c = 1000

1207
754
453

1207
754
1961

2.6561
3.2925
5.9486
5.0969
1.0455
9.1715
1.8740

3.7782
5.3933
9.1715

x = −74.8 + 500
c − x = 1000 + 74.8 − 500

c − X =

20
193
20
233

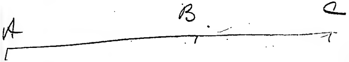
984
233
751
568
183

c = 492
10
13
13
10
538

538
269

4.8740
538 2.7308
2.1432

140
269
409



~~A B = a~~ $\quad AC = a$

~~B C = 1~~ $\quad AB = x$

$BC = a - x$

$x^2 \mathcal{F} + (a-x)^2 \mathcal{E} = \text{min}$

$x^2 \mathcal{F} + a^2\mathcal{E} - 2ax\mathcal{E} + x^2\mathcal{E} = \text{min}$

$2a\mathcal{E} = 2(\mathcal{F}+\mathcal{E})x$

$x = \frac{a\mathcal{E}}{\mathcal{F}+\mathcal{E}} = \frac{a\mathcal{E}}{\mathcal{F}+\mathcal{E}}$

247.3

247	2.3927	125
372	2.5705	247
	.8222	372

66.4. 2/3 decreasing conductor

831
44
180
10
1065

452
10
121
35
134
10
762

Same size

288
125
413

288 2.4594
413 2.6160
.8434

69.7% of distance out is the place to put the distributing box

In Block 1

1207

30
10
10
386
20
188
644
2
1288

~~204~~
185
22
235
30
472
20
452
34
335
10
831

4.5289
2.5866
1.9423

87
193
280

324
28
10
20
386
193

a = 831
b = 472
C = 24
64
25
193
20
267
20
190
25
162
30
1020

831
472
1303
a+b

831
472
a-b 359

615
544
71
20

1020
510

Same size

1

2.5551
3.1148
8.8590
4.5289
3.0086
1.5203

33.2
510
544

1000

2.25)1000(4.400
900
1000

150.
5
750.

1500.
26
9000
9000
13000
39.000

26)4400(170
26
180
0

15)170(11
15
20

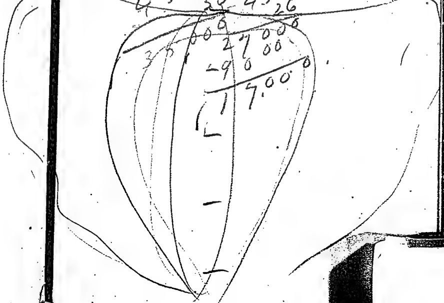
26)15900(575
130
200
188
1.20

.5)575 feet
100

5.

500
9
4500.

9
500
4500
26



21 -
38. along mill St -
20.

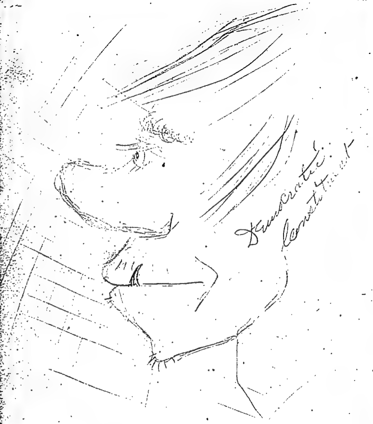
33 - 20 - 22 -

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
			18 18 18 18 18 18 18		20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20	21 21 21 21 21 21	22 22 22 22 22	23 23 23 23		25 25 25	26 26		28	27	30 30 30 30 30		32 32	33 33		35		37
			7		19	6	5	4		3	2		1	1	5		2	2		1		1

Frontage of buildings on Wall St, N.Y. &c—

38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
38 38		40						46		48 48		50 50 50 50		52		
2		1						1		2		4		1		

55	56	57	58	59	60	61	62	63
			58 58 58		60 60			63 63
			3		2			2

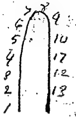

Democratic
Constituent

Menlo Park Notebook #167 [N-80-09-03]

This notebook covers the period August-September 1880. It was used by various members of the laboratory staff to record notes and drawings relating to tests of lamps, carbons, and vacuums. The label on the front cover is marked "Book for lamps Sep 3, 1880." The book contains 284 numbered pages.

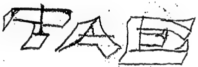
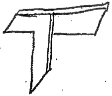
Blank pages not filmed: 26-27, 52-91, 104-109, 116-125, 128-231, 238-239, 242-259, 262-281.

X E-172 N-80-09-03



4:5/1

2	1
2	8
3	1

No Lamp	Remarks
1	Large Bamboo Aug 14 1880 the carbon had a Bad spot Close to the clamp on the Positive side and Broke with free current By T A E
2	Large Bamboo 
3	Regular 
4	Regular

No Imp	Remarks
5	Large Bamboo
6	Large Bamboo
7	Regular
8	Large Bamboo Broke By falling on the floor-

No. Tamp.	Remarks
9	Large Bamboo
10	Regular No 2
11	Large Bamboo
12	Large Bamboo

No Lamp	Remarks
13	Regular No 2
14	Regular No 2
15	Regular No 3
16	Large Bamboo

No Lamp.	Remarks
17	Regular No 8 Carbon was split in Clamp
18	Regular No 2
19	Regular
20	~~Regular~~

No Jump	Remarks
21	Regular No 2
22	Regular No 3
23	Regular No 2
24	Regular

No Lamp	Remarks
25	Regular No 2
26	Regular No 2
27	Regular no 3
28	Regular no 3

No Lamp	Remarks
89	Regular No 2
90	Regular No 4
91	Regular No 4
92	Regular No 4.

No Jany.	Remarks
93	Regular No 5
94	Regular No 4
95	Regular No 4
96	Regular No 3

No Tag	Remarks
37	Regular No 4
38	Regular No 4
39	Regular no 5
40	Regular No 4

No Lamp	Remarks
41	Regular no 3
42	
43	
44	

No Jump	Remarks
45	
46	
47	
48	

No Gang.	Remarks
49	
50	
51	
52	

Hiee Tested Sep 10, 1880

good	Bad
𝍸 𝍸 𝍸 𝍸 𝍸	||||

Hill Tested Apr 18 1880

Good	Bad Spots All Over	Single Bad Spots	Bright on one Side	Broke in Handling	Split in Fiber	Split in Clamp	Bad Spots in Middle
卌 卌 卌 卌 卌	卌 卌 卌 |		||||	||		|	|

RECEIVE. FROM. FLAMER
56. 7 Left on the pump

Hill Tested Sep 20

GOOD	BAD SPOTS ALL OVER	SINGLE BAD SPOTS	BRIGHT on one side	Broke in handling	split in fibres.	split in clamps	Bad spots in middle	

Received from Flanner-
34. 3 Left on pump

Hill Tested Sep 21 1889

Good	Bad spots all over	Single bad spots	Bright on one side	Broke in handling	Split in fiber	Split in clamp	Bad spots in middle carbon
//	///						

Hill Tried also

Good	Bad spots all over	Bright on one side	Broke in handling	Split in Fibers

Split in Clamp

Bad spots in middle of Carbon

Hill Tested do/o

Good	Bad spots all ones-	Bright on one side	Broke in handling
Split in Fiber-	Split in Clamp	Bad spots in middle of the carbons	

Hill Tested [illegible] 1880

Good	Bad spots all over	Single Bad spot	Bright in one side
Broke in handling	Split in Fiber	Split in Clamp	Bad spots in middle of Carbons

Hill Tested Sept 1880

good	Bad spots all over	Single Ball spots	Bright on one side
Broke in handling	Split in Fiber	Split in Clamp	Ball spots in middle of Carbon

Nov 9 1880

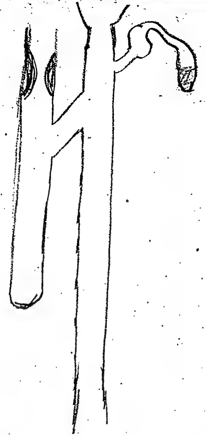
Carbon tester - Started 2-20
this pump has got the mill full
Tube contraction 80 - tube 130
the spark begin to show
in 3 minuts
5 minuts 1/8
10 minuts spark 1/2 in along the Wire
12 -- the spark has all a long
one Wire
13 -- the spark Was
on Both Wires
stopped the pump after it
had Run 15 minuts the spark
had almost left the guage

by three different ways
of bringing up Lamps

first way bring the
Carbon up to a
invisable red bring to
25 Candles and burn
for a few minuts at 25
and then to 16 and burn
for one hour

Second way put the
Current on with one
hundred ohms Res
and let burn ~~for about~~
~~one hour without stopping~~
untill you get a good
Vacuum

I treat for Lamps
have two hundred ohms Res
for this Lamp and then
get a high Vacuum
and Touch the switch
for instant only
do not let burn when
any air is coming out
of the carbon



Dec 15 - 1880

try three Lamps and see if they test different from one another —

No 1 Lamp

Put a Lamp on the pump and have 7 or 8 hundred ohms Res and bring to an incandescent Red and bring up to 25 candles for a few minutes and turn to 16 and Run for one hour at 16 Candles

Dec 15 - No 2 Lamp

Put on the pump and
have one hundred dimes
Kes get a high Vacuum
and then put the
current on and dont
take it off untill
you get a high Vacui

Lamp No 2 Dec 15 —

Put the Lamp on pump and get a high Vacuum and ~~then~~ touch the switch for an instant only dont let it burn untill 15 minutes before it is ready to come off an then let burn for 15 minutes before taken off have about five hundred shmokes dont put the ~~switch~~ current on before agin—

a burning out of the Carbons —

Dec 19 - 1880

The Latest from T.A.E on heating the Lamps is When you get a good Vacuum heat with all your Resistance in an invisible Red Keep the Current on untill you cant see any air a coming out then put in one Plug and let the air all go a gain then Second and third Plug the same as first then use your Resistance Board untill you get your Lamp up to 25 candles let burn untill all the air is gone and then let your Lamp burn for 30 minuts at 16 Candles

Mar 12 1880

Dec 27 1880

Pump 30X130 it Breaks

the face tube When used a

short time

No of Lamp	exhausted	Sealed off			

121
142
124

No of Pump	STARTED	SEALED OFF	Remarks
~~1 C 5~~	~~8.20~~	~~3.2~~	~~broke in the contention~~

0864
0864
6464
9586

7778 5990

0792
0792
6464
9957

8005 6326

No of Farms 1924 Ml Oats Ton

Remarks

Oct 4 Carbon Testers

40 x 145 did not set a Vacum quick Enough ~~to stopped to try another~~

Testes - 50 - 120

started 10 - 45

the fall tube was to small for the contractions and dident take out any air -

---

Testes - 50 X 130

Started 11 + 30

did not work the contractions was to large for the fall tube

Tester- 50 + 145
Started at 2 30

Runs to much mercury
and could not
get a V[illegible] N.G.

30 x 145 ~~Started - 2 50~~
Started 205

50 x 115 started 235
no go the full tube
was to small and
did not take the air
out fast Enough

Tests- 30-130
the spark was ~~faulty~~
[illegible] very down [illegible]
[illegible] was [illegible] 15 minutes started
to try it the second time

started the second time
at 605 the cork leaked and
did not get a vacuum.

Started again at [illegible]
and broke the pump.

Sat Nov 19 1880

heated the mercury to 180 degrees and then started the pump at 108 the spark left in 14 minutes

---

Started the pump With Lamp on at 126

oct 4

Carbon Tester

40 by 145

14 By 92

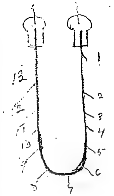
16×118

16×106

30×130

Oct. 13 Tested Carbons

Oct. 14. 1880
Position of faults
in Testing
Carbons



Menlo Park Notebook #168 [N-80-12-13]

This notebook covers the period December 1880-January 1881. The entries are by John W. Lawson and consist of notes and a few drawings relating to experiments on plating and chemically treating carbons. Sixteen loose pages found in this notebook were torn from another notebook and identified as "experiments tried." They appear to have been copied from a "Bk 2" and relate to the experiments recorded in Menlo Park Notebook #168. The book contains 283 numbered pages and has been used in both directions.

Blank pages not filmed: 1, 20-270.

Filming order: pp. 2-19; pp. 283-271 [in reverse page-number order].

~~Sept.~~ Dec. 13 —

Experiment of plating ~~on the~~ the clamping points of carbon loops with copper — Gave satisfactory results — Order to plate all the loops in the same manner.

S

~~Sept~~ Dec 18

Experiment of plating with silver — Result exceedingly good, deposit clean and homogeneous —

" "

Tried iron, using ~~the~~ double sulphat of iron & ammonia — Bright, clean deposit. —

After boiling in solution and drying in oven, they are to be taken to Neal who will treat them in reg. way — after passing through furnace their resistance is to be tested and if lowered to any extent let them be boiled again in the Pt Chl. and again treated by Neal —

Dec. 29/80.

Find I have been working with polarized batteries in plating the carbons for ~~the~~ lamps — Plating Ag & Cu.

1/4/81 — Platinized carbons — Placed the carbon loops in boiling solution Platinum chloride after they have been in solution 15 minutes they are to be taken out and ~~washed well in water for 15 minutes~~ ~~but~~ dried at a temperature of 75° C. — then placed in lamp and treated in reg. way — J.W. Lawson

Platinized loops

Resistance of loops before being treated with platinum chlorides measured over 1000 Ohms – After treatment the loops measured respectively 1000. 590 and 350 Ohms. –

1/7/81

J.W.L

+ carbons – 2 lamps of each

T.A's experiments –

No. 1 – 1 Millegramme Napthaline crystals put in globe –

No. 3 – Piece of phosphorus, dried and size of birdshot, put in globe –

No. 4 – Piece of sodium size of birdshot put in globe –

No. 5 – 3 millegrammes crystals Trichloride carbon placed in globe

No. 6 – Platinum wires and clamps coated heavily with shellac –

No. 7 – 3 Millegrammes Benzoic acid placed in globe –

1/11/81 –

Experiment No. 2

5 Milligrammes napthaline crystals dissolved in 1/2 Thimbleful gasoline – The inner surface of the lamp was then washed with this solution, the globe being heated before being washed. The lamp exhausted in reg. way –

No. 8a The lamp before being placed on pump was washed inside with strong sulphuric acid –

No. 8b – A piece of charcoal 3/16 in square was soaked in melted napthaline crystals then placed in lamp – Lamp exhausted in reg. way

No-9 A piece of charcoal 3/16 in. square was heated until redhot and at red heat was plunged under the surface of mercury, removed and suspended in bottle containing strong ammonia but not in contact with the liquid after remaining in bottle 5 minutes it was placed in lamp — pump exhausted in reg-way —

1/13/81 — No. 12 — Soaked 2 carbonized loops 2 hours in an alcoholic solution of shellac about as thick as that used for lacquering — They were then allowed to drip and dry 1½ hours; given to Neal who placed in furnace and subjected to same treatment as "reg"

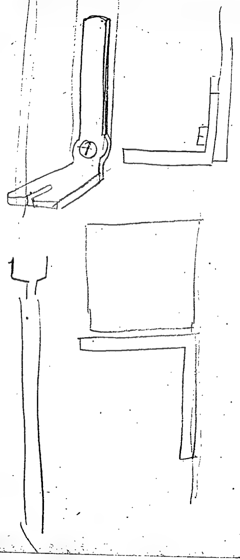
No. 12 — 1/[illegible]/80 — The resistance of the loops before treatment with shellac measured :—

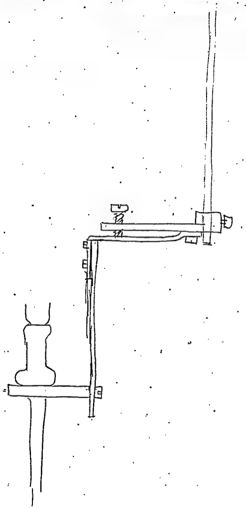
No. 1 — 215 Ohms — No. 2 — 221, Ohms

After treatment, they measured :—

No. 1 — 214 Ohms — No 2 — 223 Ohms

The carbons not so black as before treatment with shellac varnish —





For Ag bath.

1 oz. Ag converted into ~~[illegible]~~
$Ag(CN)_2$

2 oz KCy dissolved in ~~[illegible]~~ or ~~[illegible]~~ " " 9, c.c. H_2O
1250 c.c. H_2O

$\frac{2}{8^a} +$
8^b
9
6

When carbon is cold the deposit (principal part) is black

One of the clamps covered with iridescent deposit the other remaining bright

Film on glass disappearing

No. 6 – Shellac 1/11/81

When raised to high incandescence – the characteristic bulb made its appearance at the clamp. a deposit being formed on the inner surface of the globe in the immediate vicinity of the clamps (iridescent.) —

No. 8b – When first brought up to high incandescence no change from reg. appeared but after remaining so a few minutes an iridescent deposit made its appearance on the inner surface of the globe very faint

No-8a - ~~Black~~ iron grey deposit on clamps -

No-5 - ~~faint~~ becoming stronger an gen iridescent deposit in immediate vicinity of clamps -

No-8a - A few minutes after being raised to high incandescence a dark iron grey deposit forms on the clamps -

No-2 - Busted - fused platina wires, try again

Experiments on clamps -
Binding the platinum wire to the carbon by electro-deposits of copper
After exhausting

1222

~~and bringing to high incan-
descence. There was found
to be on one of the clamping
ends of the carbon just above
the clamp a fluffy substance
Not a deposit but apparently
produced from the decomposition
of some substance in the carbon
Probably the carbons absorbed
a quantity of salt having
remained in the solution
so long a time —~~

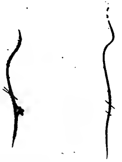
~~No. 2 = Blue around clamp
clamp around which blue
appears is blackened —~~

Nos- 8a Both broken at
curve of carbon - The
carbon being split into
shreds

[illegible] -

1/12/81 — ~~[illegible]~~ 1.45 P.M. —

No 9 — Brought up to high
incandescence - one clamp
immediately coated with an
iridescent film 1.50 P.M. —
By raising still higher
the film on clamp disappears
and characteristic blue makes
its appearance at clamp —
which ~~film~~ ~~[illegible]~~ was
coated with film —



1/2/81 - 3 P.M. -

~~Portion of [illegible] stem coated with yellowish film - Perhaps substance which was on lamp -~~

~~8th Mercury got into globe and of course the conditions of experiment were altered So Try this again -~~

[ITEM FOUND IN BOOK]

Experiments Tried.

[ITEM FOUND IN BOOK]

(1.) 1/4/81 –

Bk. 2: p. 3

Platinized Carbons
(High resistance loops)

Place the carbon loops in a boiling aqueous solution of platinum chloride, in which they are to remain 15 minutes, ~~the solution~~ being kept at the boiling point all the time – They are then to be taken out and dried at a temperature of 75° C.; then placed in lamp and treated in regular way; – or, after boiling in solution and drying in oven, they are to be taken to Neal who will subject them to same ~~treatment~~ that he does the regulars, after this boil again in platinum chloride and again heat in furnace; if, after each platinization the

[ITEM FOUND IN BOOK]

resistance of the carbons is lowered; continue the ~~treatment~~ until the resistance is as low as the regul. [Bk-2: pg. 381]

11/7/81—

A carbons—2 lamps of each—

(2) No-1— 1 Millegramme napthaline crystals put in globe — treated in regular way—

(3) No. 3— Piece of phosphorus dried and size of bird shot put in globe— Treat in reg. way—

(4) No-4— Piece of sodium, dried, size of bird shot put in globe— Treat in reg. way

(5) No. 5— 3 millegrammes crystals trichloride carbon placed in globe— Treat in reg. way— [Bk-2: pg. 5]

(6) No. 6— Platina wires and clamps to be coated heavily with shellac— Treat in reg. way— [Bk-2: pg. 3]

(7) No. 7— 3 millegrammes benzoic acid placed in globe— Treat in "reg." way—

(8) 1/11/81— No. 2—

5 millegrammes napthaline crystals dissolved in ½ thimbleful gasolene— The inner surface of the globe to be washed with this solution, the globe being heated before washed— Treat in reg. way [Bk. 2: pg. 588]

[ITEM FOUND IN BOOK]

6

(9) No. 8a — The lamp before being placed on pump to be washed inside with strong sulphuric acid — Treat in "reg" way — Bk. 2: Lf. 4

(10) No. 8b — A piece of charcoal 3/16 in. square to be soaked in napthaline crystals then placed in lamp — Treat in "reg" way — Bk. 2: Lf. 4

(11) No. 9 — A piece of charcoal 3/16 in. square to be heated until redhot in flame of spirit lamp then plunged under the surface of mercury, removed and suspended in bottle containing strong aqua ammon

but not in contact with the liquid, after remaining in bottle 5 minutes it is to be placed in lamp — Treat in "reg" way — Bk. 2: Lf. 6

(12) 1/13/81 — No. 12 —

Soak two (2) carbonized loops 2 hours in an alcoholic solution of shellac about as thick as that used for lacquering — They are then allowed to drip and dry 1½ hours; given to Neal to place in furnace and subject to same treatment as "reg" Bk. 2: Lf. 7

1/13/81 –

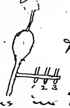
(13) Experiments on clamps
Binding the platinum wires to the carbons by means of electro deposits — [Bk.2:47]

1/15/81 —

(14) — No. 10 —
Clean the globe inside with wood naptha (pyroxylic spirit) and then exhaust — [Bk.2:48]

(15) No. 11 —
Place in the lamp 10 millegrammes of gum [illegible]

(16) No. 106 —
3 regular lamps with tubes



Fill with phosphorus anhydride, Tube No. 1,
fused, caustic potash " " 2,
with sulphur " " 3,
manipulate the carbons in regl way — Don't heat 1, 2 or 3 —

1/16/81 —

(17) — Prepared a solution to try to deposit platinum by electro means — A solution of platinum bichloride was precipitated with ammonium chloride and the precipitate well washed with alcoholic water, then a small quantity of water added to it and a few pieces of caustic potassa thrown in, this was then added to a strong solution of potassium cyanide at a temperature of 100 C., the whole was then boiled until all ammoniacal fumes had stopped being given off from the solution [Bk.2:49]

1/16/81

(18) - To the solution of (17) was added some pieces of solid platinum bichloride an then heated until the precip formed had disappeared —

Bk. 2 : p 49

(20) New style clamps — 1/15/81 —

Clamping by electro-deposition —

#1 - A^s

Placed in solution 3-P.M. 1/16/81

Taken out " 10-P.M. 1/17/81 —

Plated with copper —

In circuit of 1 Daniel's cell —

(20)

#2 - A^s

Placed in solution 11.30 A.M. 1/8/81

Taken out " 9. A.M. 1/10/81

With copper

1 Daniels —

#3 - B^s (3) —

Placed in solution 8- P.M. 1/16/81 —

Taken out " 1:30 P.M. 1/17/81 —

With copper,

1 Daniels

#4 - Spiral (1)

Placed in solution 8. A.M. 1/18/81 —

Taken out " 9: A.M. 1/18/81 —

With copper

1 Daniels

#5 - B^s (7) —

Placed in solution 2- P.M. 1/17/81 —

Taken out " 2 P.M. 1/18/81 —

With silver

1 Daniels

#6 - B^s (4)

Placed in solution 5- P.M. 1/17/81 —

Taken out " 5 P.M. 1/18/81 —

With copper —

1 Daniels through 30 Ohms —

[ITEM FOUND IN BOOK]

(20)

#7. Spiral (1)
Placed in solution 9 A.M. 1/18/81
Taken out " 9 A.M. 1/19/81
With copper
1 Davis - 20 Ohms

#9. Spiral (1)
Placed in solution 3 P.M. 1/18/81
Taken out " 9 A.M. 1/19/81
With copper
1 Davis 20 Ohms.

#10. B^s (4).
Placed in solution 9 P.M. 1/18/81
Taken out " 11 A.M. 1/19/81
With copper
1 Davis 30 Ohms.

#8. B^s (6):
Placed in solution 2 P.M. 1/18/81
Taken out " 11:30 A.M. 1/19/81
With silver
1 Davis 20 Ohms.

1/20/81

#11 Spiral (1)
Placed in solution 10 A.M. 1/19/81
Taken out " 2 P.M. 1/20/81
1 Davis 20 Ohms. With copper

(20)

1/20/81

#12. B^s (5).
Placed in solution 3:30 P.M. 1/19/81
Taken out " 4 " 1/20/81
With silver
1 Davis 20 Ohms

#13. B^s (4)
Placed in solution 5:30 P.M. 1/19/81
Taken out " 4:30 " 1/20/81.
With copper
1 Davis 30 Ohms

#14. Spiral (1)
Placed in solution 8 P.M. 1/19/81
Taken out " 10 A.M. 1/20/81
Replaced in " " "
Taken out " 10 P.M. "
With copper
1 Davis 30 Ohms
Bk. 2, p. 10

1/22/81

#15. 2 Spirals
Placed in solution 3:30 P.M. 1/20/81
Taken out " 2:30 " 1/22/81
1 Davis 20 Ohms. With copper

[ITEM FOUND IN BOOK]

 (20)

#16 - 1 Spiral -
Placed in solution 9 P.M. 1/20/81
Taken out " 2:30 " 1/22/81 -
With copper
1 Daniels - 20 Ohms

1/24/81 -

#17 - ~~2~~ B^s -
Placed in solution 10 P.M. 1/20/81 -
Taken out " 1 " 1/22/81 -
With silver
1 Daniels. 30 Ohms

1/25/81 -

#18 - 1 Spiral -
Placed in solution 4:30 P.M. 1/24/81 -
Taken out " 8:30 A.M. 1/25/81
With copper
1 Daniels 20 Ohms -

#19 - 4 A^s
1/26/81 -
Placed in solution 2 P.M. 1/25/81 -
Taken out " 8 A.M. 1/26/81 -
1 Daniels, 30 Ohms Cu

(20) 1/27/81 -

#20 - 4 A^s -
Placed in solution 3 P.M. 1/26/81 -
Taken out " 8 A.M. 1/27/81 -
1 Daniels - 20 Ohms Cu

#21 - 1 Spiral -
Placed in solution 9 A.M. 1/27/81
Taken out " 4:30 P.M. 1/27/81
1 Daniels 20 Ohms Cu

(21) 1/28/81 -

Order -
Make two lamps, regulators, etc., but carbons coated with Alumina, Zirconia etc.

✓ No. 108 - ~~Coat the carbon~~ ~~with Alumina~~

✓ No. 110 - With Magnesia -

✓ " 111 - Strontia

[ITEM FOUND IN BOOK]

16

No. 112 – With Silica –
" 113 " Zirconia
" 114 " Cerium oxide

These oxides were taken and a ~~[illegible]~~ thick paste in ether made with each, then the entire carbon was coated with this paste, by means of a camel's hair brush.

Menlo Park Notebook #171 [N-80-10-12]

There are no dated entries in this notebook with the exception of one entry for October 12, 1880. The entries are by Francis Upton and Francis Jehl and consist of rough notes and calculations relating to lamp tests from Lots 1 and 2. There is also a table of lamps in Lot 2. The label on the front cover is marked "Lot 2 of 100" and "Oct 1880 F R Upton." The book contains 284 numbered pages. Approximately half the pages have been used.

No. 1 taken off 3-37 to

measure 36 candles

put back at 3-50 minutes

$$\begin{array}{r} 3\text{-}50 \\ 37 \\ \hline -13 \end{array}$$

-13

6-50 A.M. 203 minutes

$$\begin{array}{r} 153 \\ 50 \\ \hline 203 \\ 13 \\ \hline 190 \end{array}$$

Taken off

−15

8000
65.75
142.5

1535
2
3070

8178
3.6355
1.1226
2.3070
1.3286

154
2
308

21.4
2
42.8 candles

Went 10-19 A.M.

388
19
407
15
392

A.M. 5-20 Went

20
60
33
113 minutes

93
20
113

3-43 a.m. Went

16 minutes

11-48 A.M.

$$\begin{array}{r} 448 \\ 48 \\ \hline 496 \end{array}$$

2-40 P.M

40
568
608

5-28 A.M

93
28
121

AM 8-52

$$\begin{array}{r} 273 \\ 52 \\ \hline 325 \end{array}$$

AM
~~25~~-15 ~~and~~ went

$$\begin{array}{r} 60 \\ 33 \\ 15 \\ \hline 108 \end{array}$$

$$\begin{array}{r} 93 \\ 15 \\ \hline 108 \end{array}$$

A.M 4-12 went

$$\begin{array}{r} 42 \\ 3 \\ \hline 45 \end{array}$$ minutes

$$\begin{array}{r} 33 \\ 12 \\ \hline 45 \end{array}$$

4-37 a.m

$$\begin{array}{r} 37 \\ 33 \\ \hline 70 \end{array}$$

$$\begin{array}{r} 33 \\ 37 \\ \hline 70 \end{array}$$

7-47 a.m

$$\begin{array}{r} 213 \\ \underline{47} \\ 260 \end{array}$$

The following marked
on inside front cover

went at
84 — 5.40 P.M.
57 — 5.43 "
36 — 5.43 "
98 — 5.48 globe very blue.
83 — 5.50 in glass

87 — 5.55
40 — 7.12

4-5 7 A.M 80

$$\begin{array}{r} 6/8^{3} \\ \hline 79 \end{array}$$

$$\begin{array}{r} 57 \\ 33 \\ \hline 90 \end{array}$$

4-52 P.M.

$$\begin{array}{r} 688 \\ 52 \\ \hline 740 \end{array}$$

Gone 1-15 P.M

15
508
523

6-18 AM
153
171

15

9-35 AM

$$\begin{array}{r} 333 \\ 35 \\ \hline 368 \end{array}$$

1-15 P.m

$$\begin{array}{r} 504 \\ 15 \\ \hline 527 \end{array}$$

6-50 A.M.

203 minutes

9-40 AM. ~~3??~~

$$\begin{array}{r} 333 \\ 40 \\ \hline 373 \end{array}$$

4-20 A.M.

33
20
53

Gene 9-45

333
45
378

5-45 A.M.

$$\begin{array}{r} 45 \\ 93 \\ \hline 138 \end{array}$$

5-45 A.M.

$$\begin{array}{r} 45 \\ 93 \\ \hline 138 \end{array}$$

9-28 A.M. 333
28
361

11-25 AM - 448
25
473

AM 5-26 Went

26
93
119

66
3[illegible]

6-50 A.M. 153
50
203 minutes 207

8-21 A.M. 273
21
294

7-30 AM

240
3
243

213
30
243

7-1 A.M.

180
33
213
1
214

6-16 A.M.

$$\begin{array}{r} 153 \\ 16 \\ \hline 169 \end{array}$$

8-08 a.m.

$$\begin{array}{r} 240 \\ 33 \\ \hline 273 \\ 8 \\ \hline 281 \end{array}$$

2-26 P.M.

$$\begin{array}{r} 568 \\ 26 \\ \hline 594 \end{array}$$

6-27 A.M. 153 + 27 = 180

6-24 A.M. 24 + 153 = 177

4-47

47
33
86

Went at 4-23

$$\begin{array}{r} 33 \\ 23 \\ \hline 56 \end{array}$$

Went at 3-33 A.M.

6 minutes

11 — A.M.

448

Went at 4-8 A.M.

$$\frac{38}{\frac{3}{41}}$$ minutes

$$\frac{33\ 8}{41}$$

Lamp 53 taken at 9-45
and found to be 48 candles
at 10-5 it was brought
to 68" on bar impossible

68 34 17
12 6 3

$$\begin{array}{r} 34 \\ 34 \\ \hline 136 \\ 102 \\ \hline 1156 \end{array}$$

$$\begin{array}{r} 17 \\ 17 \\ \hline 119 \\ 17 \\ \hline 9\,)\,289 \\ \hline 32 \\ 2 \\ \hline 64 \end{array}$$ candles

Kept in Photometer room

A.M. 6-9 went

93
60
153
9
162 minutes

5-33 Taken down stairs to test

5-43 brought —16

66."875

3-55 P.M.

628
45
673

55
10
45

~~[illegible]~~

5-38 AM.

$$\begin{array}{r} 93 \\ 38 \\ \hline 131 \end{array}$$ minutes

$$\begin{array}{r} 93 \\ 38 \\ \hline 131 \end{array}$$

5-41 A.M 93

$$\begin{array}{r} 93 \\ 41 \\ \hline 134 \end{array}$$

5-39 A.M

$$\begin{array}{r} 93 \\ 37 \\ \hline 130 \end{array}$$

A.M 4-35 Went

$$\begin{array}{r} 35 \\ 33 \\ \hline 68 \end{array}$$

5-43 A.M

$$\begin{array}{r} 33 \\ 93 \\ \hline 126 \end{array}$$

at 9-17 took down to test

9-30 brought back -13

3-15 P.M.

15
13
2
624
630 minutes

1-22 P.M 508
22
536

9-35 AM

333
35
368

5-41 Am

41
93
134

6 [illegible]

$$\begin{array}{r} 60 \\ \underline{93} \\ 153 \end{array}$$

[illegible]

[illegible]

6-23 A.M.

$$\begin{array}{r} 153 \\ 23 \\ \hline 176 \end{array}$$

7-25 P.M

180
33
25
238

213
25
238

9-7 AM $\begin{array}{r} 333 \\ 7 \\ \hline 340 \end{array}$

8-4 AM $\begin{array}{r} 240 \\ 33 \\ \hline 273 \\ 4 \\ \hline 277 \end{array}$

[illegible]

[illegible]
[illegible]
[illegible]
404

did not go

5-30 a.m ~~Went~~ Went 93
30
123

Burnt resistance at 1-58 and relit itself

P.M 2-4 Went 568
4
572

6-5.0 AM $\begin{array}{r}15\text{-}3\\ 5\text{-}0\\ \hline 203\end{array}$

started at 6 again

3-47 a.m Went

20 minutes

4-32 A.M. 60
2
3
65

33
32
65

5-51 A.M. 93
51
144

Went 4-47 Am

$$\begin{array}{r} 33 \\ 47 \\ \hline 80 \end{array}$$

4-45 went

$$\begin{array}{r} 45 \\ 33 \\ \hline 78 \end{array}$$

8-22 a.m.

$$\frac{273}{\underline{\;22\;}}$$
$$295$$

4-30 Taken to measure
15 candles by photometer
4-40 replaced

p.m 4-30 Taken to measure
4-48 returned
19 candles

AM 4-40 went

40
33
73

5-45 Went

$$\frac{\begin{array}{r}93\\45\end{array}}{138}$$

AM 3-57 Broke

30 minutes

10-21

273
21
294

383
21
404

~~10-21~~

10-55

383
55
438

383
55
438

P.M.

5 – 35

688
35
723
60
783

Taken off 4 – 5
put back 4 – 20 — 15

Very high
80 candles

10 – 8. Went

383
15
368
8
376

5-5 A.M.

$$\frac{93 \;\; 5}{98}$$

4-1 A.M.

34 minutes

6-22 Am

$$\begin{array}{r} 153 \\ 22 \\ \hline 175 \end{array}$$

5-27 mint
Am

$$\begin{array}{r} 93 \\ 26 \\ \hline 119 \end{array}$$

6-28 A.M.

153
28
181

60
60
33
153

4-16 troke

30
16
3
49

508 at 1 P.M
300 at 6. P. M.
808

8

12 Oct 80

Started at 2- 5 A.M.
Light red

At 2-42 About 16 candles

The belts were loose and slipped.

At 3 A.M started at 48 candles

3-02 Stopped

At 3-10 A.M, began again
" 3-11 " Stopped
" 3-30 " Started 3 minutes
Stopped 5 minute to change machines
Stopped 12-10

Lamps 46 }	808 minutes
-70 }	
-84	813
-57	816
-36	816
-98	821
-83	823
~~87~~	~~828~~
-40	845
-67	903
-29	913
-37	919
-42	925
-43	940
-53	970
-22	1130
-69	1182
-18	1220
-13	1315
-51	1355

18 $\frac{800}{140}$ 16 (1 19

808 minutes

555 Started	
600 stopped	25
	833
7-5 a.m. started	60
	890
	950
	1070
	120
2 P.M	1190
	120
4 P.M	1310
5 P.M	1370

202
202
404
134

135 : 161 :: 148 ;

2068
1703
8697
2468

177
148
29

25150
4500
29650
14825

135 : 156 :: 148

1931
1703
8697
2331

171
146
+ 23

1303
1303
6464
8297
7367

5450

Test of the Lamps That ~~are~~ were on the table and burning some time.

Frans Jahl

No 53 Test No 2

Ellf	202 - 202	135 volts. 148 ohms
R	$\frac{25150 + 4500}{200}$	
C	48	
Ewf	170 170	
R	$\frac{25150 + 6200}{200}$	
C	16	

215
215
430
143

314
15
329
164

1931
2146
8447
2526

179
164
+13

1553
1553
8069
6464
7639

5800 ft

EMF	215 – 215	143 Volts
R	$\frac{31400 + 1500}{200}$	164 Ohms
C	48	
EMF	185 – 185	
R	$\frac{31400 + 2900}{200}$	
C	16	

FR

1406
135

314
7
321
160

~~1321~~
~~1166~~

~~587~~

.8069
1303
7932
7304
2696

148 : X ::

135 : 156 :: 148 : X

$$X = \frac{148 \times 156}{135} = \frac{148 \times \frac{1}{135}}{\frac{1}{156}}$$

$$\frac{1}{X} = \frac{1351}{148 \times 156}$$

186
161
+ 25

1303
1303
.6464
7932
6602

4580

Arm 203 - 203 135 Volts

R $\frac{31400 + 700}{200}$ 161 Ohms

C 48

Arm 189 - 189

R $\frac{31400 + 2004500}{200}$

C 16

434
144.6

No 46 no 2

E117	217 – 217	144.6
R C	It went up about ~~five~~ two minutes afterwards. broke at the clamps	

(410
133

2515
42
2935
1467

1931
1673
8760
2364

172
147
+25

8240
1240
8326
6464
7270

5330

No 51 no 2

Emf	205 – 205	733 Volts
R	$\frac{25150 + 4200}{200}$	147 Ohms
C	48	
Emf	175 – 175	
R	$\frac{25150 + 5700}{200}$	
C	16	

470	376.5
156	7
	383.5
	196.7
1931	
2945	
8069	197
2945	
1931	
1931	
7655	
6464	5470
7381	

No 18   162

EMF 235–235   156 Volts

R $\frac{37650 + 700}{200}$ 197 Ohms

C Blue at the Clamp

Cut 208 – 208

R $\frac{37650 + 3000}{200}$

C

Blue at the Clamp

$\frac{400}{137}$

2515
59
3105
155.2

1931
1903
8761
2595

181
155
+ 26

1239
1239
8097
6464
7039

5050

No 40 Lot 1

Ent 200 — 200 133 Volts

R $\frac{25150 + 5900}{200}$ 155.2 Ohms

C 48

5050

Ent 170 — 170

R $\frac{25150 + 7700}{200}$

C 16

430
143

314
43
357
178

1931
2504
8447
2882

194
178
16

1553
1553
7496
6464
7066

5090

No 1 Lot 1

Cur't	215 – 215	143 Volts
R	$\frac{31400 + 4300}{200}$	178 Ohms
C	48	

Cur't	190 – 1.90
R	$\frac{31400 + 5900}{200}$
C	16

$\underline{484}$
161

(931)

37650
1600
$\underline{39250}$
196

2068
2068
6464
7077
7677

5850

13. Lat 2

Emf	242—242	161 Volts
R	$\frac{37650+1600}{200}$	196 Ohm 5850 ft lbs
C	48 Blue at the clamps	
Emf	218—218	
R	$\frac{37650+3300}{200}$	
C	18	

440
146

25150
3000
28150
1407

2 1644
2 1644
1 6464
7.9518
3.9270

8450 ft. lbs

1931
1482
8356
1769

150
140.
+ 10

EM7 ~~28~~ 220 - 220 147 Volts

R $\frac{25150 + 3000}{200}$ 140.7.

C 48 Blue at the clamp

EM7 192 - 192

R $\frac{25150 + 4500}{200}$

C 16

25150
2300
27450
137.

205
2
410
137 Volts

1931
~~1367~~

156
137
+19

1367
6464
7831

6060

No 67 Lot 2

CEMF	205 - 205	137 Volts
R	$\frac{25150 + 2300}{200}$	137 Ohms
C	48 Blue at the clamps	
CEMF	175 - 175	
R	$\frac{25150 + 4200}{200}$	
C	16	

140

314	1931	
18	2201	
332	8539	185
166	2671	166
		+19

1461
1461
6464
7799
7185

5220

Ckt 7 210 — 210 1.40 Volts

R $\frac{31400 + 1800}{}$ 166 Ohms

C 48

Ckt 7 1.79 — 179

R $\frac{31400 + 2800}{200}$

C 16

197
197
1394
131

25150
2700
27850
139.25

1931
1434
8827
2192

165
139
+26

1173
1173
8566
6464
7376 5460

Ent	197 − 197	131 Volts
R	$\frac{25150 + 2700}{200}$	139.25
C	48	
Ent	162 − 162	
R	$\frac{4400 + 25150}{200}$	
C	16	

220
221
441
·147

314
52
366
183

1931
2625
8356
2912

195
183
+12

1644
1644
7375
6464
7127

5160

Ear7	220 – 221	1.47 Volts
R	$\frac{31400 + 5200}{200}$	183 Ohms
C	48 Blue at the clamp	
Ear7	193 – 193	
R	$\frac{31400 + 7400}{200}$	
C	16	

223
446
149

314
34
348
174

1931
2405
8268
2604

182
174
8

1732
1732
7594
6464
7522

5650

7 to ~~3~~ 88 lot 1

EMF	223 - 223	149 Volts
R	$\frac{31400 + 3400}{200}$	174 Ohms
C	48	
	Blew out the Clamp	
EMF	195 - 197	
R	$\frac{31400\ 5700}{200}$	
C	16	

	No 70	Lot 2
Out R C	went up at the Clamp.	
Out R C		

235
232
467
156

2 (2550
12
314
30
349
172

1931
2355

1931
1931
6464
7645
7971   6260

Emf	Bad spot on the side 235 - 232 156 volts
R	$\frac{31400 + 3000}{200}$ 172 Ohms
C	48 Blue at the Clamp.
Emf	198 — 198
R	$\frac{5600 + 31400}{200}$
C	16

418
139

2515
23
2745
137.2

1931
1367
8570
~~1~~866

153
137
+16

1430
1430
8633
6464
7957

6240

98

Elec 7	209 - 209	139 Volts
R	$\frac{25150 + 2300}{200}$	137 Ohms
C	48	
Elec 7	182 - 182	
R	$\frac{4900 + 25150}{200}$	
C	16	

450
150

314
15
329
164

1931
2148
8239
2318

171
164
+7

1761
1761
7852
6464
7838

6070

No 42 Lot 2

Emf	225 - 226	150 Volts
R	$\frac{31400+1500}{200}$	164 Ohms
C	48 Blue at the clamps.	
Emf	196 - 195	
R	$\frac{31400+3400}{200}$	
C	16	

72.6
2
1552

314
2
316
158

1931

+ 1

1903
1903
6464
8013
8283

6730

Curr	218 — 218	155 Volts
R	$\frac{31400 + 200}{200}$	158 Ohms
C	48	
Curr	185 — 185	
R	$\frac{2000 + 31400}{200}$	
C	16	

1427
142

319
159

1931
2014
8477
2422

175
159
16

1523
1523
7986
6464
7496

5620

43 Bat 2

Emf 212 — 245 142 Volts

R $\frac{31400 + 500}{200}$ 159 Ohms

C 48

Emf 180 — 180

R $\frac{31400 + 2000}{200}$

C 16

428
143

314
5
319
159

1931
2014
8447
2392

173
159
+ 14

1553
1553
7986
6464
7506 5630

No 40 Lot 2

Emf	214 – 214	143 Volts
R	$\frac{31400 + 500}{200}$	159 Ohms
C	48	
Emf	185 – 185	
R	$\frac{31400 + 2500}{200}$	
C	16	
R		

440
147

314
15
329
164

1931
2148
8327
2406

174
+10

1673
1673
7852
6464
7662

5640

Emf. ~~240~~ ~~242~~ 220 - 220
147 Volts

R $\frac{31400 + 1500}{200}$ 164

C 48

Emf 187 - 187

R $\frac{31400 + 3200}{200}$

C 16

25.15
37
28.85

144.2

1931
1584
8539
2054

161
144
+17

1461
1461
8416
6464
7862

6030

No 91 Coil

Emf 210 210 140 Volts

R $\frac{25150 + 3700}{200}$ 144.2 Ohms

C 48

Emf 178 – 176

R $\frac{25150 + 300}{200}$

C 16

Blackened globes 7. a. m Saturday

37
40
43
51
53
67 very slightly
69 sligi

---

91 brighter Ring

31400
35700
20|37100
3|371 183
123

314
456
2|770 385
182
18
3|200
66

3|360
120

182
182
3|364
121⅓

192
193
3|385
128

180
180
3|360
120

178
177
3|355
118

183
183
3|368
122

3|358
119

172
172
3|344
114⅔

31400
4560
20|35960 (178
20
159
140
196
160
36

Lot No 2 — 16 candle power.

No	Ohms	Volts	No	Ohms	Volts
1	183	124	18	179	123
2	163	118	19	174	124
3	192	128	20	165	117
4	168	123	21	179	144
5	157	115	22	148	116
6	174	121	23	163	182
			24	172	130
7	172	120	25	n.g.	
8	171	119	26	150	118
9	181	120	27	190	134
10	185	124	28	176	124
11	185	127	29	176	118
			30	163	123
12	159	116	31	194	137
13	168	120	32	163	120
14	177	136	33	172	117
15	168	113	34	191	129
16	152	109	35	181	118
17	194	130	36	190	126
	2949	2060		3126	2300

50

Average Ohms
172

Average Volts
119

2006
2900
1784
1905
67 | 7995 | 119
67
129
average for 67

Ohms
2934
3106
2698
2812
...
172
Average for 67 Lamps

2698
2812
2949
3126
66 | 11585 | 174 Ohms
66
498
462
265
264
1

1905
1784
2300
2060
66 | 8049
122 Volts

See Page 201

Continuation of Lot - 2
of 16 Candle

No.	Ohms	Volts	No.	Ohms	Volts
37	178	116	53	162	113
38	244	140	54	187	123
39	167	117	55	172	115
40	168	113	56	184	120
41	153	115	57	187	121
42	154	112	58	177	120
43	173	119	59	179	117
44	183	120	60	178	123
45	162	111	61	182	127
46	166	119	62	165	113
47	206	124	63	194	132
48	181	118	64	too high not recorded	
49	very high not given		65	188	128
50	199	118	66	179	118
51	162	114	67	145	107
52	202	128	68	186	121
			69	147	107
	2698	1784	69 lamps 66	2812	1905

Av. Volts — 122

Av. Ohms — 174

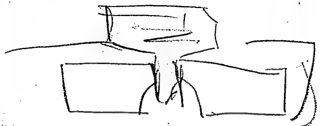
for 66 lamps

of lot 2

Em 7	R	Inert R	
1			
109	93	17	

Em7	R	Inert	
118	98	10	
118	117	12	
118	109	10	
119	102	9	

Em7	R.	Initial R
121	108	8
121	122	9
125	114	5
121	112	8
120	112	9
120	116	9
122	107	6
121	117	9
121	104	7
126	123	4
128	117	2
128	135	2



1.2

133) 2111 (16
133
781

133) 2111.8 (1.6
44
2155
133
825
38

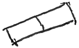
22

10,1.25
08

15
16

80 1 12

3 126.9
124



13) 2111.

Menlo Park Notebook #172 [N-80-11-15]

This notebook covers the period October-December 1880. The entries are by Francis Upton. There is also one entry by Edison near the end of the book. The book contains notes, calculations, and a few drawings relating to lamp tests and to the wiring of the lamp factory. There are also notes and calculations regarding central stations, including estimates of costs and horsepower to be sold. In addition, there are notes, calculations, and a few drawings of isolated plants for the Vanderbilt home and for a building on 5th Avenue (probably the Edison Electric Light Company headquarters). The label on the front cover is marked "Upton" and "Calculations." The book contains 290 numbered pages.

Blank pages not filmed: 276-283, 286-287.

Jos Baris
C/o Wm Porters Sons
#271 Pearl St
N.Y.

1

Graham The carbon in the clamp is estimated as being 3/16" long
0".102 wide
0".008 thick

for the two clamps this gives a cubical contents of 0.0003 cu in

If this absorbs 7.5 it ~~weight~~ bulk in air

0.00225 cu in

2352

3.3677
~~7.8861~~
8.3536
~~9.6077~~

3.3677
8.3536
2.1139

(3.8352
1.9176

82.7 Volts

The globe of a lamp holds 15.5 CC.

.061
15.5
930
9.455

.00225) 9.45500 (4202
900
455
450
500

12 Oct 3-30 A.M.

~~1~~ Blue crown clasp

23
24
25
26
27
28
30
10 Blue 31
32
34
48
49
63
14 Blue 91
15
21

Let m = resistance of 1 inch $0''.001 \times 0''.001$ square

R = Resistance of a body

$a \times b$ = cross section

l = length

$$R = \frac{l}{ab} m, \quad m = \frac{abR}{l}$$

Surface = S

$$S = 2(a+b)l$$

Problem to find the dimensions of a carbon which shall have the same surface and k times the resistance.

Same candle power

$\cancel{R'} = \cancel{k} R$

$S' = S$

$R' = \frac{l'}{a'b'} m = \cancel{k} R$

$S' = 2(a' + b')l' = 2(a+b)l = S$

~~Let~~

$l = g$ assumed

$a' \& b' =$ unknown

$a'b' = \frac{g m}{\cancel{k} R}$

$b' = \frac{gm}{a' p R}$

$s' = 2\left(a' + \frac{gm}{a'pR}\right) g$

$$a' p R S' = 2 a'^2 p R g + 2 g^2 m$$

$$S = S'$$

$$2 a'^2 p R g - a' p R S = -2 g^2 m$$

$$a'^2 - \frac{a' p R S}{2 p R g} = -\frac{2 g^2 m}{2 p R g}$$

$$a'^2 - \frac{a' S}{2 g} = -\frac{g m}{p R}$$

$$a'^2 - (\,) + \frac{S^2}{16 g^2} = \frac{S^2}{16 g^2} - \frac{g m}{p R}$$

$$a' - \frac{S}{4 g} = \pm \sqrt{\frac{S^2}{16 g^2} - \frac{g m}{p R}}$$

$$a' = \frac{S}{4 g} \pm \sqrt{\frac{S^2}{16 g^2} - \frac{g m}{p R}}$$

$$b'' = \frac{g m}{a' p R}$$

If $\dfrac{gm}{pR} > \dfrac{S^2}{16g^2}$

the result is impossible.

But if $\dfrac{gm}{pR} = \dfrac{S^2}{16g^2}$ or $< \dfrac{S^2}{16g^2}$

the problem can be solved.

$$\boxed{\begin{array}{ll} p = \dfrac{13}{16} = & \begin{array}{r} 1.1139 \\ 1.2041 \\ \hline 9.9098 \end{array} \\ = .812 & \end{array}}$$

$m = 3966 \quad = 4000$

$R = 175$

$S = 300$

$g = 4$

$p = \dfrac{130}{175}$ $\qquad \begin{array}{r} 2.1139 \\ 2.2430 \\ \hline .8769 \end{array}$

$= .753 = \dfrac{3}{4}$

$$a' = \frac{S}{4g} \pm \sqrt{\frac{S^2}{16g^2} - \frac{gm}{\rho K}}$$

$$= \frac{300}{16} \pm \sqrt{\frac{90000}{256} - \frac{16000}{839.25}}$$

16
16
96
16
256

4) 175
43.75
3
131.25

(75
18.75

4.9542
2.1931
2.7611

4.2041
2.1179
2.0862

122
405

1895
208
40.55

(26580
1.3240

4.9542
2.4082
2.5460

18.75
15.
33.75

352
122
230

(3617
1.1808

151

175
130 3/4 resistance

4/5 = 2/3 length

$$f' = \frac{gm}{a' pR}$$

$gm = 16000$
$pR = 130$
$a' = 15.1$

$$\frac{gm}{pR} = 122$$

2.0864
1.1790
.9074

8.08
33.75
41.83
2
83.66
4
334.54

17
8
$\cancel{1}$35
2
50.
6
300.

2.4771
1.3802
1.0969

~~1.25~~
12.5
4.47
8.03

3.6
16
216
36
576

4.9542
2.7604
2.1938

156

156
136
20

4.3764
2.2430
2.1334

1.3010
~~1.505~~
.6505

~~401~~
4.47

$g = 6$

$m = 3966$

$R = 175$

$S = 300$

$p = 1$

3966
6
23796

$$a' = \frac{S}{4g} \pm \sqrt{\frac{S^2}{16g^2} - \frac{gm}{pR}}$$

$$= \frac{300}{24} \pm \sqrt{\frac{90000}{16 \times 36} - \frac{23796}{175}}$$

= 8.03
16.97

sli - 91

1.2730
2
2.5460

3966
4
15864

4.2004
2.1179
2.0865

351.8
122
229.8

2.3616.
1.1808

18.75
15.15
33.90

18.75
15.15
3.60

$$b' = \frac{gm}{a' \, p R}$$

4.2804
8.4698
7.8861
.5563.

3.6

$$a' = \frac{SS'}{4g} \pm \sqrt{\frac{S^2}{16g^2} - \frac{gm}{pR}}$$

$pR = R' = 130$

$m = 3966$

$S' = 300$

$g = 4$

$p = \frac{130}{175}$

$$a' = 18.75 \pm \sqrt{351.8 - 122}$$

33.9
3.6
37.5
2
75.0
4
300.0

$$\begin{array}{r} 1.096\,9 \\ 2 \\ \hline 2.183\,8 \end{array}$$

$$\begin{array}{r} 152 \\ 122 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 5.47 \\ 12.5 \\ \hline 17.97 \end{array}$$

$$\begin{array}{r} 1.4771 \\ \hline .7385 \end{array}$$

$$\begin{array}{r} 12.5 \\ 5.47 \\ \hline 7.03 \end{array}$$

To change the surface

$S' = 200$

$$a' = \frac{200}{16} \pm \sqrt{\left(\frac{200}{16}\right)^2 - \frac{9m}{pr}}$$

$$a' = 12.5 \pm \sqrt{152 - 122}$$

$$a' = 50$$

$0''.007 \times 0''.018 \times 6''$.

$pr = Q'$

$$\begin{array}{r} .8751 \\ 2 \\ \hline 1.7502 \end{array}$$

10″

$S' = 300$

$g = 10$

$m = 3966$

$pr = R' = 300$

$$a' = \frac{S'}{4g} \pm \sqrt{\left(\frac{S'}{4g}\right)^2 - \frac{gm}{pR}}$$

$$\frac{300}{40} = 7.5$$

$$\begin{array}{r} 17 \\ 8 \\ \hline 136 \end{array}$$

$$\begin{array}{r} 2.1335 \\ 2.1614 \\ 6.2218 \\ \hline .5167 \end{array}$$

3286

$S = 2(a+b)l$

$$\begin{array}{r} 17 \\ 8 \\ 25 \\ 2 \\ \hline 50 \\ 6000 \\ \hline 300\,000 \end{array}$$

Lamp No. 67 of Lot 2 giving 16 candles ~~and~~ with a resistance of 145 Ohm. This lamp was made ~~of~~ the best bamboo ~~that~~ has yet been found. Mr. B. said ~~that~~ it was absolutely without pith.

All linear measurements in 0.001

$l = 6000$

$a = 17$

$b = 8$

$R = \frac{l}{ab}\,m$

$S = 300\,000$

$R = 145$

$m = \frac{abR}{l} = 3.286$

4.0969
2
2.1938   15.6

4.1189
2.1614
1.9575   156
90.7
65.3

1.8149
.9074   8.08

12.5
8.08
4.42
20.58

$$a' = \frac{S'}{4l'} \pm \sqrt{\left(\frac{S'}{4l'}\right)^2 - \frac{l'm}{R'}}$$

$S' = 200000$
$l' = 4000$
$m = 3.286$
$R' = 145$

3.286
4000
13 154.000

$\frac{\cancel{200000}^{100}}{\cancel{16000}_{8}} = 12.5$

$a' = 20.58$
$b' = 4.42$
25.00
2
50.0
4
200

O.K.

4.1189
2.1461
1.9728

156
~~9.39~~
93.9
62.1

1.7931
.8965

12.5
7.88
4.62

4.1189
2.1303
1.9886

20.38

1.7679
.8839

156
97.4
58.6

12.5
7.65
4.85
20.15

4.1189
2.1139
2.0650

156
101
55

1.7404
.8702

12.5
7.42
5.08
19.92

Same values as on page 29
except $R' = 140$

$a' = 20.38$
$b' = 4.62$

$R' = 135$

$a' = 20.15$
$b' = 4.85$

$R = 130$
$b' = 5.08$
$a' = 19.92$

4.1189
2.0969
2.0220

2)1.7076
.8538

4.1189
2.0792
2.0397

1.6721
.8360

156
105
57

12.5
7.14
5.36
19.64

156
109
47

12.5
6.86
5.64
19.36

4.1189
2.0414
2.0775

1.5611
.7805

156
119.6
36.4

12.5
6.03
6.47
18.53

$R = 125$

$a' = 19.64$
$b' = 5.36$

$R = 120$

$a' = 19.36$
$b' = 5.64$

$R = 115$

$R = 110$

$a' = 18.53$
$b' = 6.47$

156
131.5
24.5

$\frac{1.3892}{.6946}$

12.5
4.95
7.55

4.1789
1.9542
2.1647 12.5

156
146
10

3.16
9.34
15.66

$$\frac{gm}{pR} = \frac{\delta^2}{16g^2} \qquad \frac{lm}{R'} = \frac{S^2}{16l^2}$$

$$\frac{16 l^3 m}{S^2} = R'$$

5.3010
16.6020

4.000
4.000
16.000
4
64.109
16
384
64
1.024

3.0103
0.5166
~~2.4937~~
9
~~11.4937~~

3.5269
12

~~11.4937~~
10.6020
12.5269
10.6020
1.9249

R = 100

a' = 17.45
b' = 7.55

R = 90

a' = 15.66
b' = 9.34

R = 84.1

a' = 12.5
b' = 12.5

2.3010
1.2553
11.0457
2
21.914

123.5

D.5766
3.6532
4.1698

147.80

2.1614
2.0084

123.5
102
21.5

(1.3324
.6662

11.1
4.64
15.74
6.46

4.1698
2.1761
1.9937

123.5
98.6
24.9

(1.3962
.6981

11.1
4.99
6.11
16.09

$l = 4500$

$$\frac{4500 \times 4}{18000}$$

$S = 200000$

$m = 3.286$

$R' =$

$$a' = \frac{s'}{4l'} \pm \sqrt{\left(\frac{s'}{4l'}\right)^2 - \frac{l'm}{R'}}$$

$$\frac{200000}{18000} \quad 11.1 \pm \sqrt{123.5 - \frac{147.80}{R'}}$$

$R' = 145$

$a' = 15.74$

$b' = 6.46$

$R' = 150$

$a' = 16.09$

$b' = 6.11$

4.1698
2.2141
1.9657

123.5
92.4
31.1

1.4928
.7464

11.1
5.58
5.52
16.68

4.1698
2.2304
1.9394

123.5
87.
36.5

1.5623
.7811

11.1
6.04
5.06
17.14

4.1698
2.2553
1.9145

123.5
82.2
41.3

1.6160
.8080

11.1
6.43
4.67
17.53

R = 160

a' = 16.68

b' = 5.52

R = 170

a' = 17.14

b' = 5.06

R = 180

a' = 4.67

b' = 17.53

4.1698
2.1461
2.0237

123.5
105.5
18

1.2553
.6276

11.1
4.24
6.76
1534

123.5
109.5
14.0

4.1698
2.1303
2.0395

1.4461
.7230

11.1
3.74
7.36
14.84

4.1698
2.1139
2.0559

1235
11.36
9.9

1.9956
.4978

11.1
3.15
7.95
14.25

140 = R
a' = 15.34
b' = 6.76

R = 135 Ohms

a' = 14.84
b' = 7.36

R = 130 Ohms

a' = 14.25
b' = 7.95

4.1698
2.0969
2.0729

1235
11.83
5.2

1.7160
3580

11.1
2.28
8.88
13.38

4.1698
2.0792
2.0906

123.3

$R' = \dfrac{16\, l^3 m}{s^2}$

3.6532
3
10.9596
1.2041
0.5166
4.6998
4.6990
22.0783

2.0783

$R = 125$

$a' = 13.38$
$b' = 8.88$

$R = 120$

$a' =$
$b' =$

$R = 119.7$ Ohms

$a' = 11.1$
$b' = 11.1$

$\mathcal{L} = 10000$

$\mathcal{S} = 200000 \quad m = 3.286$

$R = 250$

$$a' = \frac{S}{4l} \pm \sqrt{\left(\frac{S}{4l}\right)^2 - \frac{l^2 m}{R}}$$

$$\frac{200000}{40000} = 5 \pm \sqrt{25 -}$$

$a + b$

ab

$a + b : a' + b' :: R : R'$

$$R' = (a' + b')\left(\frac{R}{a + b}\right)$$

$S = ab$

$ab : a'b' :: S : S'$

$$S' = \frac{a'b'S}{ab}$$

$$\frac{\begin{array}{r}17\\8\end{array}}{136}$$

$$\frac{\begin{array}{r}12\\12\end{array}}{144}$$

$144 : 136 :: X : 165$

$$\begin{array}{r}2.1584\\2.2175\\7.8665\\\hline 2.2424\end{array}$$

1749

$$\frac{\begin{array}{r}17\\8\end{array}}{136}$$

145

$$\begin{array}{r}2.1335\\2.1614\\\hline 4.2949\\2.1584\\\hline 2.1365\end{array}$$

19700

$a+b : a'+b' :: S : S'$

$S' = \frac{(a'+b')\,S}{a+b}$ $\mathcal{L}$ = Constant

$ab : a'b' :: R' : R$

$R' = \frac{ab\,R}{a'b'}$

$\mathcal{L} = 6000 = \ell$

$S = 300$

$a+b = 25$

$a = 17$

$b = 8$

$R = 145$

$a = 16$

$b = 9$

$\overline{144}$

$R = 137$

4.2949
2.1761
2.1188

4.2949
1875
.1074

2949
1931
1018

2949
1004
1945

12.5
12.5
2949
1938
1011

.0969
1938

2949
0569
2380

a' = 15
b' = 10
150

131 Ohms

a' = 14
b' = 11
14
14
154

128 Ohms

13
1.2
26
13
156

12.5 = a
12.5 = b

127 ohms
126.30 Ohms

1.8
7
126

157

19
6
114

173

20
5
100

197

1.0174
2
2.0348

2949
0348
2601

2949
0269
2680

2949
0111
2838

2949
9859
3090

2949
9494
3455

2949
8984
3965

6" carbon $l = 6000$

250 surface $S = 250000$

~~300~~ 6 : ~~250~~ 5 :: 12.5 : X

5
6 | 62.5
10.416 +
10.416
20833

182 Ohms

11.83
9.
106.47

185.4

12.83
8.
102.64

192.1

13.83
7.
96.81

~~204~~
203.8

14.83
6.
88.98

227.5

15.83
5.
79.15

249.2

9202
2
1.8404

2949
8404
4545

2949
8203
4646

2949
8061
4888

2949
7659
5290

6" carbon
200 Surface

$l = 6000$
$S = 200000$

$300 : 200 : 12.5^2 : X$

$3\overline{)25}$

$X = 8.33$

$a = 8.333$
$b = 8.333$

284.7

9.666
7
67.662

291.5

10.666
6
63.999

308.1

11.666
5
58330

338.

$$\begin{array}{r} 15 \\ 15 \\ \hline 75 \\ 15 \\ \hline 225 \end{array}$$

$R = \frac{l}{ab} m$

$$\begin{array}{r} 3.6990 \\ \cancel{7.1031} \\ 6.5166 \\ \hline \cancel{1.3187} \\ 7.6478 \\ \hline 1.8634 \end{array}$$

~~206~~

73

$$\begin{array}{r} 2.3522 \\ \hline 4.2156 \\ 2.3502 \\ \hline 8654 \end{array}$$

$$\begin{array}{r} 2156 \\ 3444 \\ \hline 8712 \end{array}$$

$$\begin{array}{r} 2156 \\ 3345 \\ \hline 8811 \end{array}$$

5" carton $l = 5000$

$S = 300000$

$5000 \overline{)300000}$ 160 75

$S = 2(a+b) l$

$a = b$

$4a^2 = \frac{S}{l}$

$a = \frac{S}{4l} = 15$

$a = 15$

$b = 15$

73 ohms

$$\begin{array}{r} 16 \\ 14 \\ \hline 64 \\ 16 \\ \hline 224 \end{array}$$

73.3

$$\begin{array}{r} 17 \\ 13 \\ \hline 51 \\ 17 \\ \hline 221 \end{array}$$

74.3

$$\begin{array}{r} 18 \\ 12 \\ \hline 36 \\ 18 \\ \hline 216 \end{array}$$

76.

2156
3201
8955

2156
3010
9146

2156
2765
9391

2156
2455
9701

2156
2068
9088

2156
1584
0572

2156
0969
1187

19
11
19
19
209

78.6

~~200~~
10
2000

82.5

21
9
189

86.9

22
8
176

~~87.5~~
93.3

23
7
~~[illegible]~~
161

.102

24
6
144

114.1

25
5
125

131 Ohms

Length 5'' ~~[illegible]~~ $l = 5000$

Surface $= 250 = S = 250000$

$$S = 2(a+b)l$$

$$R = \frac{l}{ab}\, m$$

$a = b$

$S = 4al \qquad a = \frac{S}{4l}$

$$\frac{25\cancel{0000}}{2\cancel{0000}} = 12.5$$

2.0414
2.0414
1.6464
7.7930

5.7292

3.5222

3328

1.0792

2.4430

277

33000 4.5185
2.4430

2.0755

119

3.2 : 8 :: 150
3.25

8
3.25

3.2
65
675
5

16
Lamp 153 Ohms at 16 candle

110 Volts on line.

12 candles
154.5 Ohms 105.5 Volt

105.5 : 110 :: 154.5 :

2.1889
2.0414
7.9767

2.2070

161. ohms
154.5

6.5 Ohms

~~3500~~ 800
~~3200~~
~~12~~ 3

266

5.7292
~~7~~.7637 2355
3.4929 (3110
388

4.5185
2.5888
1.9297 8 (85 candles per HP
10

5.7292
2.2926
3.4366 4(2730
~~6~~8.2

4.5185
~~2.9455~~
~~1.5730~~ ~~3~~
~~2.9455~~
~~4.5185~~ 4
4.5185
2.8338
1.6847 (488
12.2

8 candles

156.7 Ohms
100 Volts

100 : 110 :: 156.7
1567
172.37
156.7
15.6 Ohms

---

4 candles

161 Ohms
~~151.3~~ Volts
90.3 : 110 :: 161
161
17710

4.2483
1.9557
2.2926

19.6
161
35 Ohms

166 ohms

82.6 ; 110 :: 166

166

18260

~~7~~4.2615

1.9170

2.3445

221

166

55 ohms

5.7292

2,3445

3.3847

2435 | 1217

4.5185

3.0856

1.4329

2 | 13.5

Lamp 6" X 0".012 X 0".012

16 candles 110 Volts

.115
3.14

$\bar{1}.0607$
0.4969
$\bar{1}.5576$

.361

Central Station (1)

Estimate for 10000 lamps fed from a central station each giving 16 candles

It is found that 8 of these may be obtained of from one horse power indicated

Say that a gas burner giving 16 candles consumes 5 feet of gas an hour for comparison

.200 hours for 1000 feet or 10000 lamps will consume 50000 feet an hour

Call it in electricity an equivalent of a 1000 cu.

feet of gas an M (1)
50 M an hour

250 M a day
310 days in year in the
district chosen

310
250
15500
62
77,500 M ~~cu~~ feet a year

~~Old~~ estimate
$159.300 invested

5.2022
4.8893
.3129

$2.05 investment per M.

at 8 per H.P. 10000 (1)
Lamps will take 1250 H.P.
It is estimated that
1200 H.P. will be able to supply this amount.
This can be placed in one building 25' X 100'.
The iron structure is estimated in Book 100 p. 50
120.000 lbs of iron
.05

$6000.00	$6.000
Foundation	2.500
Fire proof floors	2 000
	18,500

Boilers 600 H.P (1)

Babcock and Wilcox estimate, see letter.

600 H.P. boiler in place with economizer	$12,875
Stack	800
Steam pump	375
Blowers,	300
Engine with counter-shaft	650
Piping	165
Ash elevator	400
Coal bunker	800
600 H.P.	$ 16365

1200 H. P. Boilers (1)

Complete Boilers	$24,500
Stacks	1600
Steam Pumps	750
Blowers	600
Dynamos for Blowing	1000
piping	330
Ash Elevator	400
Coal bunker	1000
	$30180

Engines Dynamos (1)

Mr. K. estimates cost at

$ 4800
10
48000

Extra Electrical apparatus
$ 2000

lbs of H_2O in one Gall
= .16 Cu ft

7959 6.25 Galls in Cu ft

6.25
10
62.5 lbs in Cu. ft.
100
6250 lbs. for 7.5 cts

.8779
3.7959
3.0820 .0012

.0012 cts per lbs
30
.0360 cts per hour per H P.

Total (1)

Building	8.500
Boilers	30180
Engines Dynamos	48000
Extra Electrical	2000
	88680
	2000
	90680
Conductors	
1750 Ohms lamp	527000
Pipes	
	57000
	88680
	145680
Meters	5000
	150680
	2000
	152680

85

48000
.03
1440.08

57600
.03
172800

365
20.5
1825
730
7482.5

365
20.5
1825
730
7482.5

Depriciation

Station Boilers	10%	$ 3018
Building	2%	170
Engines Dynamos	3%	1440
[illegible] Electrical	[illegible]	40
Meters	5	250

Conductors

2% in whole 57000 .02 114000 — 1140

6058

365
5
\# 1825

Labor

1	Engineer chief		5.00
1	Engineer		300
1	Wiper	@ 1.50	1.50
1	Fireman	@ 2.25	2.25
1	fireman	@ 1.75	1.75
2	Laborers	@ 1.50	300
1	Regulators	@ 2.25	2.25
1	Regulator asst	@ 1.75	1.75

20.50
365

Year 7482

Data

\$200 per H.P. per year
~~XXXX~~ delivered

Present machine cost \$350.
good for 70 lamps

Conductors copper	27000
Pipes	25000
Insulation	5000
	\$ 57000.

The labor account is taken thus a chief engineer who will be on duty from 12 M to 12 midnight an assistant who will be on duty from 12 mid-night to 12 M. a wiper who will be on duty from 7 a.m to 7 P.M.
One fireman @ $2.25 who will be on duty from 12 M to 12 midnight
One fireman @ $1.75 who will be on duty from 12 midnight to 12 M
One laborer from 7 am

to 7 P.M another
from 12 P.M to 12 midnight.
One regulator @ $2.25 from
12 M to 12 midnight one
@ $1.75 from 12 midnight
to 12 M.
Thus the cheif engineer will
be on duty during the
most important part of
the day, and the wiper will
be under each of the engineers.
The head fireman will
also be on duty and have between
5 & 6 P.M two laborers.
This system will offer
a good chance for promotions

365
365
3915.

2240) 18000 (8.03
17920
8000.

8.03
28
6424
1606
22.484

22.5
365
1125
1350
675
8212.5

daily

Executive expenses
year $4000

Coal

$2.80 per ton delivered
3 lbs per H.P. per hour

1200
3
3600 lbs per hour
5
18.000 lbs per day
8.03 tons per day
$22.50 daily
$8212.5 year

15000
.02
30000

Lamps
9000 yearly
.35
3000
10,500

Oil, waste, water taken
as 1/3 coal
Yearly $ 2737.

Rent insurance Taxes $ 7,000

Summary

Depreciation	$ 6058
Labor	7,482
Executive	4,000
Coal	8,212
Oil-waste &c	2737
Rent &c	7000
	$ 35489
Lamps	10,500
	45.989

152.7) 1593 (104
152 7
6 600
346
1693

152680
76340
229020

9125) 45740 (50
45625
00115

Cost 50 cts per M

136875 68437 205312	91250 225 45625 18250 1825 205312

If 10000 lights can be sold for 5 francs daily & it is equivalent to 250,000 cu feet ~~cu. feet of~~ gas.

365
250
18250 ~~Annually~~
0.730
91250
1.50
4562500
9125
Receipts 136875.00
Expenses 45989
90.886 ~~left~~ to pay for patent rights and interest

1527) 90845 (59
7635
14490
13743
747

301.3) 9088 (30%
9039
49

If company capitalizes at twice the cost of plant $150680
2
301,360

The receipts will pay a dividend of 30 per cent.

60% on investment.

72) 72

Now for estimate ~~under~~ worst conditions and giving all margins.

6 per H.P.

2½ hours a day

Machine for 72 lights to cost ~~[illegible]~~ $500

Belts &c 100

Building ~~double~~ ½ again as ~~as~~ much ~~again~~

219 hours per lamp

Conductors $80,000

Coal $5.00 per ton

1200 H.P.

7200 lights

Investment

Structure	10 500 5 250 15 750	15 750
Boilers		30,180
Engines		24,000
Dynamos 100		50,000
Belts &c		10 000
Conductors		80 000
Extra Elec		2 000
Meters		5 000
		216930

$$
\begin{array}{r}
12750 \\
.02 \\
\hline
255.00
\end{array}
$$

Worst,

Depreciation

Structure	2%	$ 315
Boilers	10	3018
Engines	3	720
Dynamos	3	1500
Belts	5	500
Conductors	2	1600
Extra Elec	2	40
Meters	5	250
		$ 7943

Labor	$ 7482
Executive	4000
Coal	8796
Oil waste &c	2932
Rent &c	10000
Lamps	10 500
	$ 51653

Five hours use

all items expense same except Coal & water & Lamps

	51653
Coal &c	8796
	2932
$	63381
Lamps	10.500
	73881

Receipts

49.275
2
98550
73881
24669 profit

Coal

Is taken as three hours daily to supply 2 1/2 hours

1200 H.P.
9 lbs per H.P. per day

2240) 10800 (4.82 tons
8960
18400
17920
4800

say

4.82
5
2410
365
1205
1446
723
$ 8796.50 yearly

2089) 547.0 (2→6
4178
1292

~~547~~

208.9) 1710.0 (8,2
1671.2
388.0

∴ 8.2% on investment
at $150 for M

2090) 5135 (24
4180
955

208.9) 8550. (40
8356
1940

Receipts ~~1/2 of page 97~~
2 1/2 hours · 5 hours

136.875 · 136.575
 · 51.303
 · 85572

$ 68.437
51.303

$ 17.134 = 40% of five hours

~~208~~ 10% on investment

6.6% on investment
watering 1/2

at $225 to compare with gasoline

68.437
34.218
102.655
51.303
51.352

24% on investment

 (2) Receipts

7200 lamps
.2.5 hours
36000
144
180 000 per hours for lamp
5
9.0,0 00 cubic ft daily
365
90
32850
$1.50 per M M
1642500
32850
49,275.00

7200) 300000 (41
288
120

1600000
365
90000
108
54
3000)657000
219 hours per lamp

Costs 51653
Receipts 49.275
Loss $2378

At $2.25 the present price of gas in N.Y.

49.275
24637
73912
51303
$ 22609 or 18% on capital,

See page 106 for five hours use same lamps

With present plant (3)

6 per H. P. indicated

1200 Horse power

7200 lamps

3 per year

Coal $2.80 per ton at station

Building 1/2 again as much

Conductors $57.000

Five hours use a day

Investment

Structure	15 750
Boilers	30,180
Engines	24 000
Dynamos	35 000
Conductors	57 000
Extra Elec	2 000
Meters	5 000
	$168,930

7200
3
21600
.35
108000
64800
7560.00

Depreciation

Structure	2% p105 $	315
Boilers	10%	3018
Engines	3	720
Dynamos	3	1050
Conductors	2	1040
Extra Elec.	2	40
meters		250
		6633
Labor	p. 85	7,482
Coal	p 93	8,212
Oil &c		2,737
Rent & Taxes		10,000
Executive		4,000
		39,064
Lamps		7560
		$ 46624

Receipts .

page 110 \$49.275
2
98550
46624
\$ 51,926.

168.9) 51,92 (30
5067
1250

\$1.50 per M

30 % on investment

75) 10000 (134
75
250
225
250

1500 H. P.
10000 Lamps
6.6 per H. P.
134 Machines 75 lamps @ $350
134 Belts ~~[illegible]~~ @ ~~50~~
Average use five hours
Lamps costing 35 cts.

134	134
75	350
670	670.0
938	402
~~9900~~	46,900
10050	

13400
6600

Investment (B)

Structure		15,750.00
Boilers	30000 / 7545 / 37725	37,725.00
Engines	24000 / 6000 / 30000	30,000.00
		6700.00
Belts		46,900.00
Dynamos		
~~Electrical~~ Testing Apparatus		3000.
Conductors		57000.
Meters		5000.
		207075.

46900
.03
1407.00

3.65
150
18250
365
547.50
7482.
8929.50

18212
2053
10265

Expense (B)

Depreciation

Structure 2% 210 105 315	315
Boilers and accessories 10%	3772
Engines 3%	900
Belts 10%	670
Dynamos 3%	1407
Testing Apparatus 2%	60
Conductors 2%	1140
Meters 5%	250
	$8,514.
Labor	8029
Executive	4000
Coal	10265
Oil &c	3422
Rent Insurance &c	10000
Lamps	10500
	54,730

202,1) 150,6.0 (74
14147
9130

202 075
101 037
303112

74
24
50

202.1) 82,15 (40.6
80 76
13900
11 4

41
14
27

202

Income

(B)

$2.25

205,312
54,730
$ 150,582

74% on investment of $202,075

Investment increased 50% for patent rights $ 303112

50 % on investment

$1.50 Income $ 136,875
54,730
$ 82,145

41% on investment

27% on investment increased 50% to $302,962

Power

1 Horse power at 8 pumps
per H. P. furnishes 40 feet
an hour or takes 25 hours
to make 1000 cu. feet

6 cts an hour per H. P.
at $1.50 per M this is 6 cts per
hour per H. P.

100 H. P. 10 hours daily

112055
100160
·342
3463

70
27

60
266
534

8212.50
2737.50
1095000
2190
876.0

8212
1642
6570

65695
21905
87600
21900
109500

10,500
2100
8400

205,212
41.062
164,250

152,680) 122,510 80
1.22 144
366

164250
54750
109500

15.27) 67.76 (43
6308
4680

Estimate A modified (4)
four hours a day

Same Plant $152,680

Same depreciation &c, Same Expense except coal,
oil, &c 1/5 less

35530,50
2190
33340.50
8400
41,740 50

Lamps 1/5 less

$2.25

Income 1/5 less

164,250
41,740
$ 122,510

80 % on capital
53 % on watered stock

109500
41,740
67,760

$ 1.50

43 %

29 % on watered

7)1200
7
8400

7)12000 | 1
1714

1200
7
8400 lamps
8

365
4
1460 h
8400
584000
1168
12264000

30,660
.35
153300
91980
1073100

8(10000
1250
8750

Estimate A modified (D)

four hours a day
7 per H.P.
lamps last 400 hours

Same plant as (A) $ 152,680

Same coal Depreciation as (C) 33,340,5
lamps 10,731
44,071.5

Est-A, mod, To (B)
400 @ (T)
1Reel Page H, 157

8400 lamps
4 hours 2 feet

33600
5
168000
~~365~~
109.20

365
168
2920
2190
365
61320
1.50
306600
61320
$ 91,980.00

lamps
8400
4
336.00

61,320
225
306600
122640
122640
~~306600.00~~
137970.00

Income

$1.50

91,980
44,071
47,909

152,680) 47,900 (31% on investment
45804
21060

20% on watered plant.

$ 65,429.00

$ 152,680.00

1200 H.P.
3
3600 lb hour
4
14400 day

365
14400
146000
146
365

2240) 5256000 (2346 tons year
4480
776
672
1040 = 1040
896
1440

2346
3.5
11680
7008
$ 8176.00

Coal

2737
91.2
$ 1,825
8,176
10,001
8,760
1,241

2340
3.50
11700
7020
$ 8,190.00
Coal

8190.00
1825
10,015.00

(E)

Same as D 7per H.P. 4 hours

Except coal $ 3.50 per ton

Conductors $ 75,000 400 hours life

Depreciation on conductors 3%

75000
57000
18000

152,680
18000
Investment $ 170,680.

Depreciation 3% on 75000
3
225000
1140
$ 11,10.00

More than D 1241.
" " D 33340.5
35691.5
10731
$ 46.4225

6098
1110
7208

16569.50
164237
82187.87

~~Ho~~ 365 days
4 hours

1460 hours ~~8400~~

58 ~~4000~~

1168

~~Ten~~ 12264 ~~000~~

61320

2.25

306600

12264
12264

13797000

11200
7

8400

*

(E)

Income same as (D)

91,880
46,422

45.458

170.7)45.46(2.6.5 %
on $170.680
34 1.4

11320
10442

8780

18% on watered stock

$85,340. for Patent Rights

365

Lamps 1/7 less

10731
~~1522~~ 1533
~~9209~~ 9198

1200
6
7200

365
4
1460
7200 lamps
2.92800
.16220

400) 10,512,000
26,280
35
131400
78840
9198.00

Present system 1200 H.P.
6 per H.P.
400 hours life
$75.000 in conductors
on which 3% depreciation

4 hours average use
$3,50 per ton for coal

Investment 202.075
18000
Conductors add $ 220675

Expense except lamps same as (E)
$ 35.691.5
Lamps 9209
$ 449005

$2.25 per M

78757
39378
118,135
44900
220) 73,235 (33.3 % on investment
66
72
66
63

22.2 % on watered stock

1/7 61,320
52,560,000 cu ft
2.25 per m
118,260.00
41,269.00 Expenses
76,991.00 Net Income

Receipts 1/7 less than (B)

78840
39420
118260

191880
13140
78849
44900
33857

220) 33,8 (15.4 % on investment
220
1180
1100
800

$ 220.075

$ 110.000 for Patent Right

10.2 % on watered investment

202075 / 76,991.00
38 %

200 H.P. in Power sold
daily 10 hours

2000 H.P. one hour

Cork 1 ~~Hand~~ Power 34
each may be counted as bringing
10 cts. per day Mr Kinney says
1 H.P. 6 cts. an hour
10 hours
60 cts

Count each as 1/4 H.P.

8.5 H.P.
33
2.50
5
3
14
7.5
9
7
9
5

7083 H.P. to rent

70
7 Horse

77 Horse power in Book
1 under 5 horse each.

Book 2
12 sewing machines
1/6 H. P
= 2 H.P.
.16
1 ~~.02~~
.75
50
50
25
6 00

11.16 H. P

77
11.
1.2
~~6~~4

~~16~~ 4 H.P. in four books

Book 3

32 Hoists each 1/5 H.P.

6.4 H.P
1.5
1.
2
10.9 H P
1.
11.9

Book ~~3~~4

77 Hand powers
14 H.P.
60 Estimated Counted
~~7~~4 H.P.

/152,680.00/852,238.25/

300 H.P. at least for
Ten hours
600 H.P for 5 hours
1200 H.P. for 2 1/2 hours
all the plant 2 1/2 hours

87,600.
1.50

438000
87600

$ 91,980.00

Est-(I B)

Page 131

~~Since the life of 1 lamp is 400 hours which at 5 hours per day's use is Equivalent to 80 days duration.~~

~~And, Since 5 cu ft per hour is the Equivalent of 1 light or 25 cu ft per day~~

~~then the life of 1 lamp would be equivalent to 2000 cu ft of gas and with 43,800 lamps would represent an equivalent of 87,600,000, cu ft of gas~~

~~365 d~~
~~5 h~~
~~1825~~
~~8~~ ~~9600~~
~~1095000~~
~~16425~~
~~17520000~~

~~H.P.~~
~~1200~~
~~8 per HP~~
~~9600~~

~~400 / 17520000 /~~
~~43800~~
~~lamps used per year~~

33000 4.5185
4312 3 6347

7.65 .18838
22 1.3424
2.2262

168 candles per HP

33000 4.5185
3535 3.5484
9.3 .9701
1.0792
2.0493
112 candles

Calculation for
House ~~~~

16 candles 128.4
15 127.2
1.2 Volts

for a candle

1% of resistance in
conductors

150 Ohm lamp.

1.5 Ohms

50 feet 1.5 Ohms

$$\begin{array}{r} 24.8 \\ 12.4 \\ \hline 37.2 \end{array}$$

256 ; 340 :: 37.2 :

$$\begin{array}{r} 34.0 \\ \hline 8 \end{array}$$

$$\begin{array}{r} 1.5705 \\ 2.5315 \\ 7.5918 \\ \hline 1.6938 \end{array}$$

49.4 feet

Copper pure

Wire 1 ft. long 0".001 diameter having a cross section of one circular mill.

9.718 Ohms

97 : 100 9.718 Ohms : 10.2 Ohms

$$R = \frac{\ell'' \times 10.2}{\text{Cross section}}$$

$$\text{Cross section} = \frac{\ell \times 10.2}{R}$$

$\frac{\ell}{2} = 25$ $R = 1.5$
$\ell = 50$

$$\text{Cross section} = \frac{\overset{10}{\cancel{50}} \times \overset{3\times 4}{\cancel{10.2}}}{\underset{.3}{\cancel{1.5}}} = 340$$

$\ell = 100$ $\frac{\ell}{2} = 50$

Cross section = ~~170~~ 680

$\ell = 150$ $\frac{\ell}{2} = 75$

Cross section = a = 1020

Wire 1 ft long 0".001 in diameter

12 × 0".001

1000 feet of wire

0".010 in diameter weighs

0.3026 lbs.

0".001 in diameter weighs

.003026

1 foot weighs

.000003026 lbs
340
25 feet

.0257 lbs
2 wires
.0514

6 4808
2 53.5
1 3979
2.4102

$l = 200 \quad \frac{l}{2} = 100$

$a = 1360$

$l = 250 \quad \frac{l}{2} = 125$

$a = 1700 \quad \frac{l}{2} = 150$

$l = 300$

$a = 2040$

$l = 350 \quad \frac{l}{2} = 175$

$a = 2380$

$l = 400 \quad \frac{l}{2} = 200$

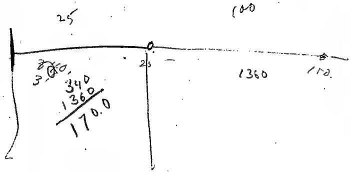
$a = 2720$

$l = 450 \quad \frac{l}{2} = 225$

$a = 3060$

$l = 500 \quad \frac{l}{2} = 250$

$a = 3400$.



~~Ohio~~

2 Ohio

3400	3 5315
3364	3, 5268
	·0047

10·1

3364	3.5268
·3026	$\bar{1}$.4808
	1·0076

.0257 × 4 = .1028

.0257 × 9 = .2313

.0257 × 16: 1642, 257, 4212

.0257 × 25: 1285, 514, 6425

.0257 × 36: 1542, 771, 9252

0257 × 49

$\bar{2}$.4102
1.6902
.1004

0257 × 64

4102
8062
1.2164

0257

4102
9542
9542
3186

4102
0414
0414
4930

4102
0792
0792
5686

4102
1139
1139
6386

4102
1461
1461
7024

See page 165

line to factory

2 Ohms

$$
\begin{array}{r}
.0106\,\big)\,1.0000\;(\cancel{56}\text{ lbs to ohm} \\
\underline{530} \\
700 \\
\underline{636} \\
640 \\
\underline{636}
\end{array}
$$

~~1132.2 lbs to~~ 2 Ohms

1132 lbs .2 Ohms

~~10 to 1 — 20 Ohm~~

0.5

~~2.75~~

~~87 lamps~~

2
600
$6000

1500
150

181

181
16
1086
181
2896

2900

120) 150 (1.25
120
300
240
600

300
22
660

1.25
.125

.125) 2000 (16
125
750
750

~~1000~~

20
~~600~~

2000
.16
18000

4000
.22
8800

Line To Factory

2 ohms C

1 Ohm No 10 wire
weighs 90.6 lbs

.0106) 1.0000 (90.6
954
600

181 lbs in 2 ohms

1200 lamps per day
2 hours on pumps
5 lamps per pump

240 lamps at 20 candles
6 per H.P
~~8 400~~ H.P.
120 lamp at a time
20 H.P

340 mils 1ft long

sp. g. Cu = 8.9

.000340	$\bar{4}$.5315
3.14	0.4969
Comp 4	9.3979
12	1.0792
8.9	0.9494
50	1.6990
	.1539
.03612	2.5575
	$\bar{2}$.7114
.0514	O.K.

1000. feet No 10 wire
weighs 54. lbs.

~~225~~ 54

250
4 wires in & out
for 54 lbs.

$\frac{30}{\$\,16.20}$

24 wires

$$\begin{array}{r} 16.20 \\ 6 \\ \hline \$\,96.20 \end{array}$$

3 100 light

1450
4
5800

17956) 580000 (30 wires
84
580000

18

59 light
158 feet

4
7

2100
4
8400
60
504000

1790) 504000 30 10 wires

E 60 Lamps

1400
4
5600
60
18 / 336 000 — 20 No 10 wires

~~A~~ B 32 — 1000
4
4000
32
128.000

D

189 Ohms

.5 1/2 mg

1 1/2

12 feet

75

10

15 15

~~10~~ 15

50 feet high

10 lamps

99

500
100

17)50000 (3 wires
6 wires
9 wires

152,680.00 / 852,288.75
763,400.00
88,888.75

Hamilton

4

1 Dining Room

3.5
8.
28.0
16
44 feet

~~4.5~~
2

Say 50

25

680
2
1360
25
6800
2720
34000

2 No. 10 wires
1 No 6 wire

See page 212 for calcu.

Total
~~160~~
200 feet No. 18 wire in entry

16,620 mills in 1A

3rd Story Line A

To ~~LA~~ 10 lamps

In hall 6, Rooms 2

Distance from Basement

$$\begin{array}{r} 20 \\ 15 \\ 15 \\ \hline 45 \text{ feet} \end{array}$$

To hall lamps

Average 56 feet

101 feet to hall

$$\begin{array}{r} \cancel{1360} \\ 1360 \\ 2 \\ \hline 2720 \\ 6 \\ \hline 16620 \end{array}$$

1 No 10 wire for 6 Hall lamps

200 feet No. 22 wire

2720 mills in A

16620
2720
19,340

40 feet No. 18 wire down

Line A 3rd floor

4 lamps in rooms

25 feet average

separate line

340
2
680
4
2720

Line A 2nd Story

26 lamps

20 in hall

6 in Chamber

56 feet

30

86 feet in hall

See page 213

Entry

~~150~~ 200 feet No. 6 wire

40,800

100 feet No. 17 wire

9000 mills through A

A line 2nd Story

75 feet

1020 mills
2 1/2 pounder

2040
20

40800

Nos 880

6 in Chambers

25 feet 3 line

average 25
30
55 feet

750
2
1500
6
9000

3000 mills

see page 215

~~150~~ 200 feet No. 6 wire

40,800 mills

100 feet No. 10 wire

23.200 mills
2
46 400

page 216

A line 1st floor

Nov 1880
JKL

60 lamps

Hall 20 lights

56 feet out
20 from basement
76

1020
2
2040
20
40,800

Drawing room

40 lights 2 lines

30
25
55

580
2
1160
20
23200 2

A

30 feet No. 10

30 feet 4 No. 10 wires

40 feet 8 No 10 wires

In Basement

~~[illegible]~~

A line

Nov 1880

JRU

2nd to 3

16.620
2.720
19,340 mills
40 800
pt to 2nd 9 000
69,190
40.800
46,400
17,958) 156,340 (8

100 feet No. 16 wire

8000 mills
30 feet No. 14 down

50 feet No. 18 wire
75 feet No 15 wire

6000 mills down
8000
14000 30 feet No. 11

B line

Nov 1880

3rd floor 4 lamps

25
45
70

1000
2
2000
4
8000

Two circuits 4000

2nd floor 5 lamps

avg 25
30
55

700
2
1400
2
2800
4 2
6000

~~100~~ 175 feet No. 12 wire

27200
14000
41200

down

40 feet No ~~=~~ 6

B line

1st floor

LRU
Nov 18 80

20 lamps.

30 feet
20
50

680
2
1360
100
13600
13600
27200

C line — TRLM Nov 1 1889

Same as B

D same as B

50 feet No. 19

~~[illegible]~~ ~~19~~

3200 [illegible]

30 feet No. 17

~~75 feet No 22~~

60 feet No. 19

30 feet
No. 14

$$\begin{array}{r} 4080 \\ 3200 \\ \hline 7280 \end{array}$$

[illegible]

E Line

Nov 1880
[illegible]

3rd floor

2 lamps

$$\begin{array}{r} 20 \\ 45 \\ \hline 65 \end{array}$$

$$\begin{array}{r} 800 \\ 2 \\ \hline 1600 \end{array}$$

2nd

50 feet

$$\begin{array}{r} 680 \\ 2 \\ \hline 1360 \\ 3 \\ \hline 4080 \end{array}$$

100 feet 2 No 10
Or 100 feet No 6

40 feet

$$\begin{array}{r} 68000 \\ 7280 \\ \hline 18)\ 75280\ (4 \end{array}$$

4 No 10 wires

Σ First floor
50 lights Nov 1880

$$\begin{array}{r} 3.5 \\ 8 \\ \hline 28.0 \end{array}$$

20 feet to ceiling
28 feet

50 feet to go

$$\begin{array}{r} 680 \\ 2 \\ \hline 1360 \\ 25 \\ \hline 6800 \\ 2720 \\ \hline 34000 \\ 2 \\ \hline 68000 \end{array}$$

on side

sides

mills down

150 feet No. 16 wire

30 feet No. 12 wire

11424 mills.

~~Roof~~ 100 feet No. 13

19040 mills down

F 3rd floor
8 lamps

Nov, 22, 1880

25 feet
45
70

952
2
1904
~~4 circuits~~
38088
3 circuits
11424

2nd floor 32 lights
Parlor
room 1 circuit

25 feet
50
75

952
2
1904
5
9520
2
19040

50 feet No 20

1360

~~75~~ 100 feet 2 no. 10
or no. 6

32646
1360
19040
11424
18) 64470

4 No 10 wires
30 feet

7 2 in bedroom Nov. 22, 1880.
~~30 feet~~
25 feet

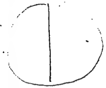
$$\begin{array}{r} 340 \\ 2 \\ \hline 680 \\ 2 \\ \hline 1360 \end{array}$$

20 in conservatory

$$\begin{array}{r} 32 \\ 30 \\ \hline 62 \end{array}$$

$$\begin{array}{r} 816 \\ 2 \\ \hline 1632 \\ 20 \\ \hline 32640 \end{array}$$

1000000



G

Jan. 22 1884

~~Curr~~

100 lamps from top of

building ~~75~~ 30

20

110

160

2176

100

18) 217.600 (12 No. 10 wires

18

37.

back to street

Distributing

100 feet No 065

	$\bar{6}.4808$
108,800	5.0374
40	1.6021
2	.3010
26.3 lbs	1.4213

	$\bar{6}.4808$
60,928	4.7860
	1.8457
	.3010
30. lbs	1.4129

$\bar{6}.4808$	
4.7267	53.312
1.8451	
.3010	
1.3536	22.5 lbs

Basement

A 100 lamps 40 feet

Nov. 22, 1880

544
2
1088
100
108,800

B 32 lamps 70 feet

952
2
1904
32
3808
5712
60,928 mills

C ~~28~~ lamps 70 feet

952
2
1904
28
15232
3808
53,312

	$\bar{6}.4808$
82824	4.9180
104	2.0170
	0.3010
52.1 lbs	1.7168

	$\bar{1}.4808$
165648	5.2261
104	2.0170
2	0.3010
	2.0189

104 lbs

D 104 feet 29 lamps

Nov 22 used

1428
2
2856
29
25704
5712
82,824 mills

E 58 lamps
104 feet

2856
58
22848
14280
165,648

.60000 3026 $\bar{6}.4808$
217600 5.3385
158 2.1987

2.0180
3010

208 lbs 2.3190

~~Total Wt~~ $\bar{6}.4808$
474,368 5.4760
2.0414
3010

200 lbs 2.2992

F. 59 Lamps
158 feet Nov 2 2 1888

2176
2

4352
59

39168
21760

256,768

G 217,600 mils 100 lamps
110 feet

217.600
256.768

474,368

1,163 $\lfloor .0657$
.0328

1.08" diameter

Weight in basement

Nov 22 1880

26.3
30
22.5
52.1
104.
208
200.

64.2,7 lbs. of Cu. in Basement

$ 474,368
217 600
165 648
82 824
53 312
60 928
108 800

1,163,480

From page 178
Line A

$\bar{6}.4808$
4.2200
1.9542
2.6560

16,620.

4.5 lbs
4
18.0 lbs

16,620
8,215
4,107

Put 16.620 ×
4
66480 mills to top A
200 feet
Then No:16 wire in entry

.056
.06

from page 182
Line A

Nov 22nd

$\bar{6}.4808$
4.6107 40,800
70 1.8451
.9366

8.64 lbs

4 | 40800
10.200

200 feet No. 12 wire

40,800
4
163200 mills

8.64
4
34.56 lbs

Vanderbilts house
Nov 2

| 40800
10200

200 feet No. 12

6.4808
4.6107
1 60 = 1
.6936

4.94
4
19.76 lbs

40800
4
163200

from page 184

Line A

11.600

$\bar{6}$.48066

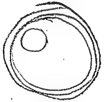
4.6665   46400

1.6021   40

.7794

5.61
2
11.22

46.400
2
92800



Line A summary

Vanderbilts house
Nov. 2 2

Hall 3rd

200 feet ~~No. 16~~ = 0".065

Chamber 3rd

200 feet ~~No. 20~~ = 0".03

Hall 2nd

200 feet ~~No. 12~~ = 0".100

Chamber 2nd

200 feet 0".050

Hall 1st

200 feet 0".100

100 feet 0.100

To run to lamps in fixtures

100 lamps 6 feet each

600 X 2 = 1200 feet 0".030

 Line A

I propose to put in one pipe
500000 mills of Cu.
In the other as much as possible

66.480
2720
163 200
163 200
~~92 800~~
488400

$\bar{6}$.4808
5.6990
7.9542
2.1340 136 lbs.
~~.3010~~
~~1.4350~~ ~~272~~

12000
.3
36.00
$ 360

Vanderbilt's
Line
Nov. 22

Line B Total

Chamber 3rd floor

100 feet 0".065

Chamber 2nd floor

50 feet 0".065

100 feet 0".050

Parlor

175 feet 0".1 60 feet ~~0"~~.2

40 feet 0". ~~[illegible]~~ 2

100

32 lamps

Lines C & D same as B

46240

Line E / Total

Vanderbilt's house

Nov 22

50 feet 0".05

60 feet 0".05

Dining ~~room~~

125 feet 0".2

30 feet 0".065

30 feet 0".1

4 no 10 wires 40 feet

75250 mills

F lines Vanderbilt house

Nov 22

150 feet 0".065

100 feet 0".1   30 0".1

50 feet 0".03   70 0".2

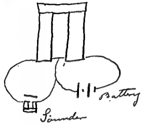
100 feet 0".2

G

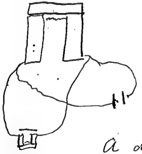
100 .065"

March 12, 1879.
Book 1 Page 121

The discharge from a magnet was measured



A click could be heard when the current was Taken off.



a double click could be heard

A duplex point was used to break the main circuit and the discharge thrown the sounder Results when no armature was on the magnet the discharge was

stronger, sharper and
of shorter duration than when
the armature was on

Book 1 Page 137

Tests of the power that could
be turned
Batchelor 10.963 ft. lbs
20 seconds

Francis 16.146 ft. lbs
10 seconds 15.225

Martin 14,100 ft. lbs
20 seconds

Geo. Carman
14,106 ft. lbs
20. seconds

Albert Swanson
17,191
15.750.

Kruesi 15750
14.445

Book 1 Page 245

If an armature has 10 lbs. of Cu on it and a resistance of 1 Ohm with 100 convolutions

If 10	Ohms	316	convs
5	"	223	"
4	"	200	"
2	"	141	"
1	"	100	"
1/2	"	71	"
1/3	"	59.7	"
1/4	"	50	"
1/9	"	33	"
1/16	"	25	"
1/25	"	20	"

Book 6 Page 40

The combustion of a cu. ft. of common gas will heat 65 gallons of H_2O 1° Fahr.

Haswell

1 Gall = 8.32 lbs.

```
  8.32
    65
------
  4160
 4992
------
 540.80
      5
-------
2704.00
   772
```

```
 33000
    60
-------
1980000
```

1,980,000) 2,087,488 (1.07

2,087,488 ft lbs

1 Gas burner burning 5 cu. ft an hour gives off a little more heat than is required to run a horse power for an hour.

Estimate for rewinding - Dec 6 1880

The small cast iron motor which gave 32.6 Volts at 1640 revolutions per minute from six turns in a division

It can be run with safety 2500 r. p. m.

1640 : 2500 :: 32.6 :

```
              2500
            163000
             652
164x) 815000  (49
      6566
      1590
```

49 volts

Say 50

The most that will ever be needed for any lamp will be 150 volts and this can be obtained at 2500 r. p. m

3 X 6 turns in each division

18 turns

.045
.011
56

Dec 24

Armature 37 Coils

@ 5" diameter

3.14
5

3.7
2
74

74) 15.70 (.21
148
90

0".21 for space

118
60

5
3

To be wound with .021 wire

1/9 4 × 20/6 = 40/3 = 13.3
.6.1
133
798
9.113

9.1 Ohms

Magnet 6" iron

wire
$$\begin{array}{r} .049 \\ .011 \\ \hline .060 \\ 6 \\ \hline .36 \end{array}$$

$$\begin{array}{r} 30 \\ 70 \\ \hline 2100 \end{array}$$

$$\begin{array}{r} 40 \\ 60 \\ \hline 240 \end{array}$$ minute

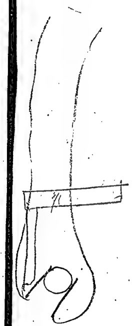
$$\begin{array}{r} 46 \\ 70 \\ \hline 3020 \end{array}$$ feet

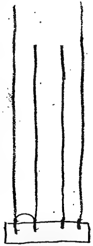
$14.6) 70 (5$

5 lbs. of wire

Dec 6 1880 FRU

Arrangement for testing Lamps at Factory





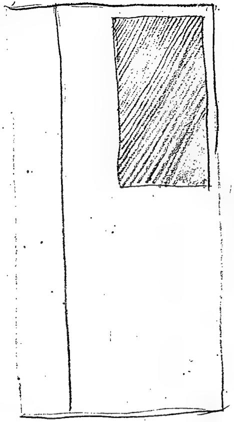
$$C = \frac{\mathcal{E}}{R+r}$$

$\mathcal{E} =$ Constant

$$C = \frac{\mathcal{E}}{R+r}$$

$$R+r = \frac{\mathcal{E}}{C}$$

$C = 1$ Weber



The machine can only run the lamp to be tested. For if it has its field to run, the current to the field will interfere with that to the lamp.

Let C_e = current to lamp
C_m = " " magnet

Drop in machine

$$= E_a = (C_e + C_m) R_a$$

$$C_e R_e = E_e = E - E_a$$

$$C_m R_m = E_m = E - E_a$$

$$C_e R_e = C_m R_m$$

The magnets from the machines must be fed from main line to factory;

For a standard light

Candles standard are the best but very expensive. a Carcel oil lamp would also be very good

I think a kerosene oil lamp using rather a light oil ~~with reservoir fed by a~~ siphon the same as a student lamp so as to keep a constant height of oil. A student lamp would do.

This could be standardized
to candles at intervals.
so as ~~to~~ give eight candles
or any given number

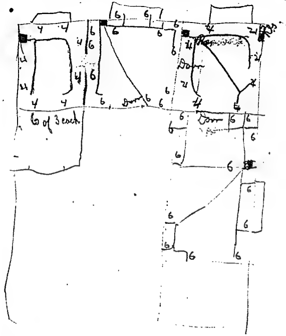
There will be a double
switch so as to put the
machine either on a
resistance or on the
lamp which is to be tested
The machine will be run
at 2000 r.p.m. and the
connection made through the
Electro Dynamometer ~~[illegible]~~
~~[illegible] deflection~~ and
the deflection read. The
magnet is adjusted until

The deflection is brought to a standard amount which will have been calculated to follow from having ~~[illegible]~~ 140 Volts on the line

1st floor

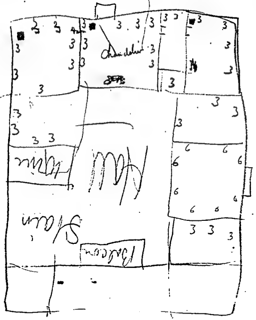
5th Ave

13
78

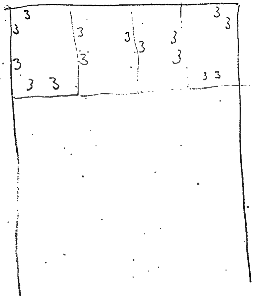


2nd floor

for room underneath 50 lights



3rd Floor



6889 mills in No 14 wire

A line omitting all lights to the hall

Third floor 9 lights

3 lights 16 feet

204
3
612 mills X 3 = 1836

3 light 16 feet
612 mills X 3 = 1836

3 lights 8 feet

Down 153 mills X = 459

9 lights 35 feet through pipes
476
9
4284
3
12852

2 No 14 wires
1 No 12 wire

A line second story

18 lights 20 feet

$$\begin{array}{r} 272 \\ 20 \\ \hline 5440 \\ 3 \\ \hline 16320 \end{array}$$

1 No 10 wire for second story

A line 1st story

12 light 50 feet

$$\begin{array}{r} 680 \\ 12 \\ \hline 1360 \\ 680 \\ \hline 8160 \end{array}$$

OK

9 lights 35 feet ~~+ 12~~

$$\begin{array}{r} 476 \\ 9 \\ \hline 4284 \\ 11424 \\ \hline 15708 \end{array}$$

12 lights

Down

No. 10 wire

B line 3rd Floor

Floor 24 feet 6 lights

$$\begin{array}{r} 340 \\ 6 \\ \hline 2140 \\ 3 \\ \hline 6420 \end{array}$$

No 14 wire

Down ~~476~~ 12 feet 6 lights

~~35 feet~~

12 lights

3/2 the Cu

$$\begin{array}{r} 476 \\ 12 \\ \hline 952 \\ 476 \\ \hline 5712 \\ 2856 \\ \hline 8567 \\ 2856 \\ \hline 11424 \end{array}$$

~~Feet [illegible]~~

~~No. 12 wire~~

B line 2end Floor

12 lights

Down

20 feet

$$\begin{array}{r} 272 \\ \underline{\times\ 12} \\ 544 \\ \underline{272} \\ 3264 \end{array}$$

No. 14 wire

B line 1st floor

O. K

carry wires to Basement

C line 3rd same as B

Dmg No. 12 wire

2nd Floor
21 lights 20 feet

$$\begin{array}{r} 272 \\ 20 \\ \hline 5440 \\ 3 \\ \hline 16320 \end{array}$$

No 16 wire

1st O.K

D line

Third floor

10 lights

35 feet 4765

Down 3

No. 11 13295

12 lights Second story

20 feet 272

12

544

272

3264

3

9792

No. 12 wire

1st O.K.

E Line

15 lights 3rd Floor

35 feet

476
15
2380
476
7140
3
21420

Down

No. 10 wire

40 lights 2nd Floor

20 feet

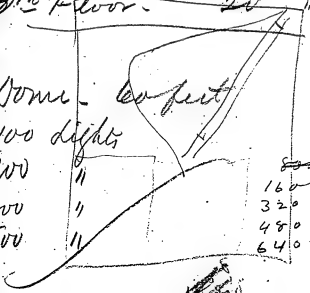
272
40
10880
3
32640

2 No. 10 wires

1st O K

1st Floor ~~—~~ 50 lights
2nd Floor — 20 "
3rd Floor — 20 "

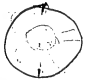
Dome — Confect



100 lights
200 "
300 "
500 "

800
~~8000~~
160000
320000
480000
640000

300
50
15000



3 No 5 for each
100 lights

Summary

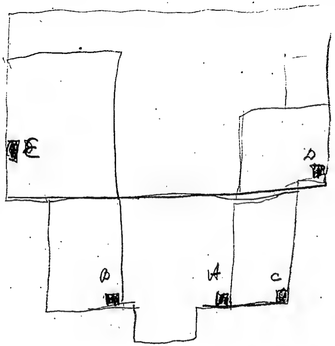
Line A
9 lights From 3rd down 1 No. 12 wire
clear through 9 lights
From 2nd down 1 No. 10 ~~wire~~
18 lights ~~5~~ ~~wires~~
4 wires

Line B
From 3rd down 1 No. 10 —
clear to basement 17 lights
From 2nd down 1 No. 14 —
12 lights

Line C
From 3rd down 1 No 10 —
17 lights
— 2nd — 1 No. 10 —
21 lights

Line D
From 3rd down 1 No. 12 —
10 lights
" 2nd " 1 No. 12 —
12 lights

Line E
From 3rd down 1 No. 10 —
15 lights
From 2nd 2 No 10 —
40 lights


E
D
B
A
C

$$\begin{array}{r} 120. \\ 3 \\ \hline 360 \\ 60 \\ \hline 420. \\ 5 \\ \hline 2100. \end{array}$$

75 c
17
92 —

11) 398 (36
33
68
66
2

150

10c lnr per Ton
7 c Ammonia Liqr

4800. Engine
1833 — Wire.
2500 piping Piping
2100 Boilers —
550 feedwater pump
300 piping —
800 flooring structure,
400 Blower-Bunkers
250 Station apparatus,
260 Stack & setting
13783.

12) 22000 (1833.
12
100
96
40
40
36
40.

7

3 5000.

120
12
240
120
1440.
1520
1

21
12
42
21
25200

~~[illegible]~~

120
8
960 Lights

4 lbs per hp — 120
4
480 — hours
5
2400.

) 5000.

Meters 100 — 500
Investment 13783.
960 Lights —

ton coal per hours
~~5 [illegible]~~
~~at 3~~ — $18 — per 5 hours
Engineer 3
Oil water 0.50
18 50
8 Lamps 2.50
Dep 1.50
1.50.
Rent Taxes Ins. 25
2455
1200
1255

Dep. 4 p.c. or [illegible]
520 per year — or 1.5 c per night

13
40
520.

d
365
5 h
1825 kil
9600
17,520,000
43,800

H P
1200
8
9600

61320 ~~Cu ft gas~~
1,50 per M
3066000
61320
91,980,00

91980
46802
45,178

Apr 15 1886

170,680.
45,178
341360
1104200
1024080

76/1255 (14
76

365
304
61

76
20
320

76

76
16
456
76
121

960
16
5760
960
15,360
76,800

76
50
3800

Menlo Park Notebook #174 [N-80-11-09]

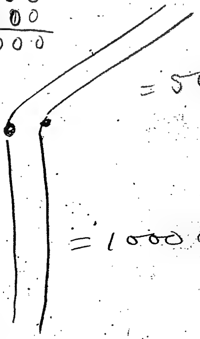
This notebook covers the period October-November 1880. Most of the entries are by Francis Jehl. There are also a few entries by Francis Upton. The book contains notes and calculations relating to lamp tests. A few of the entries concern tests of meters. The label on the front cover is marked "Lamps C" and "Francis Jehl." There is an index on the inside front cover. The book contains 282 numbered pages.

Blank pages not filmed: 234-235, 264-265.

Index.

Res one arm of Bridge
To. 3 ohms

$$
\begin{array}{r}
12600 \\
1400 \\
\hline
14000
\end{array}
$$



= 500

= 1000 ohms

 First Lamp. good vacuum.
Em7 182 - 183 pt 3683

R $\frac{31400+4500}{200}$ = 179 R

C 16 first test

at oct 27 another test

R 193
pt 3529

25150
5800
20 | 3095 0 (154)
109
100
9

Em7	167 - 167 1110
R	$\frac{25150+5800}{200}$ 1.54 R
C	16 pt Clamp 5544

167
167
3 | 334
11.1

154

154) 545820 (3544
462
838
770
682
616
660

The following on inside of front cover.

$R^0 = \frac{4}{5} \quad \frac{4}{5} = 1^0 C$

$\frac{4}{5}$

$\cancel{20}^C$

$x C^0 = \frac{4}{5} R$

$20 R = x C^0$

$20 : x : \frac{4}{5} : 5$

Elut	218 218 1450
R	$\frac{37650 + 6800}{2000}$ 222R
C	16 Fe 4195

$$\begin{array}{r} 37650 \\ 6800 \\ \hline 20)\overline{44450} = 222R \\ 604 \\ \hline 88 \\ 85 \end{array}$$

$$\begin{array}{r} 218 \\ 2 \\ \hline 3)\overline{436} \\ \hline 145 \end{array}$$

6

3e

7

Em 7	190 — 190	126 v
R	$\frac{37650}{200}$	188 R
@	16	Je ~~3070~~ 3730

190 ÷ 3 = 126

200) 37650 (188

70 33 10 (3740

EM7 189 − 189 126 v

R $\frac{37650 + 200}{200}$ 189 R

C .16 J_c 3721

189
2
3)378
126

37650
300
20)37950(189
20
179
160
195

[illegible] (3721

Emt	188 188	1220
R	$\frac{37650 + 300}{200}$	189 R
P	16 Fe	34 ...

188
2
3 | 376
122

37650
200
20) 37950 (189
20
179
160
195
188

189) 659360 (3488
567
928
756
1512
1512
1640
7

6

Eu7 192 − 192 = 128

37650 + 4200 209

2000 3473

@ 16 Pe

192
2
3)384
128

37650
4200
20)41850(209
40
1

209)725810(3473
627
989
836
1531
1463
680

7c

Emf 192-192 1280

204 R

R $\frac{37650 + 3200}{200}$

Te 3552 /

C 16

192
2
3)384
128

37650
3200
20)40850
204

204)725810 (3552
612
1138
1020
1180
1020
600

γe

Eut 191 — 191 127v

R $\frac{37650 + 3700}{200}$ 206 R

C 16 Je 3468 filo

$$\begin{array}{r} 191\frac{1}{2} \\ 3\overline{)382} \\ 127 \end{array}$$

37650
3700
20) 41350 (206
40
135

206) 61880 (3468

618
965
824
1412
1236
1760

9e

Elect	184 − 184 123 P
R	$\frac{37650 + 2000}{200}$ 198 R
C	16 3384 lb

184
2
3368
123

37650
2000
20)39650(198
20
196
180
165
160

198)670210(3384
594
762
594
1681
1584
970

198
2
1584
7

Elut 203 - 203 1350

R $\frac{31400 + 500}{200}$ 159 R

C 16 5077 lbs

This one has a plant,

$$\begin{array}{r} 202 \\ 3\overline{)406} \\ 135 \end{array} \qquad \begin{array}{r} 31400 \\ 500 \\ \hline 2\overline{)31900} \\ 159 \end{array}$$

159) 807340 (5077
795
1237
1113
1240

Elut 190 -190 1230
188R

R $\frac{37650}{200}$

C 16

20) 3765 (188
120
160

3564 / lb

190
2
3) 380
123

188) 670?0 (35.4

1062
940
1221

130

1a Ni

EMF 193 − 193 129 V

R $\frac{37650 + 1500}{200}$ 195 R

C 16 3750 A 166

of ... the Carbon

$193 \times 2 = 386$, $386 / 3 = 128$

$2 \quad 37650 + 1500$

$20 \overline{)39150} \quad (195$

196
180
115

$195 \overline{)737250} \quad (3780$

585
1522
1365
1570
1560
0 5

Eut 173 – 173 1150

R $\frac{31400 + 500}{200} = 159$ R

C .76 36-1 ...

Agin the globe

$$\begin{array}{r} 173 \\ \times 2 \\ \hline 3\,)\,346 \\ \hline 115 \end{array} \qquad \begin{array}{r} 31400 \\ 500 \\ \hline 2\,)\,31900 \\ \hline 159 \end{array}$$

$$\begin{array}{r} 159\,)\,55570\;(368 \\ 477 \\ \hline 1087 \\ 954 \\ \hline 1347 \\ 1327 \\ \hline 250 \end{array}$$

Emf 173 − 173 = 115 v
155 R

R $\frac{31400 + 4700}{200}$ 3779 ohms

C

.16

31400
4700
2|36100
155

173
3|346
115

155) 58578 (377.9
465
1208
1085
1231
1085
1520
1395

Poorly Clamped

Elev 207 2⁰/₁ 1380

R $\frac{37650 + 4500}{200}$ 210 R

407 ft

C 16

$$3 \overline{)\, 414}$$ 207 ÷ 2 = 138

$$\begin{array}{r} 37650 \\ 4500 \\ \hline 20)\,42150 \end{array} \quad (210$$

$$210)\,84350 \quad (407 \quad 1550$$

16e Ni

Ent 198 − 198 = 1320

R $\frac{37650 + 6500}{200}$ 220R

3509.4 .05

@ 16

198 − 198
2 | 396
132

37650
6500
20 | 44150 (22
40
41

220) 772020 (3509
660
1120
990
2020

17 Ni

Em7	195 − 195 = 130
R	$\frac{37650}{200}$ = 188 R
	392 × 1.6
©	16

195
3)390
130

20)37650 (188
176
160
165

188)73770 392.6
564
1846
1792
547
376
1710

223) 1499.2 (3574

872

Emf 200 - 200 1330

R $\frac{37650 + 7000}{200} = 223$

3574 lbs

C 16

Blue at the lamps and Hg in the globe

3)400 133

37650
7000

20)44650(223
40
46
40
65
60

19e ni

Em7 190 − 190 = 127 v

R $\frac{37650 + 700}{200}$ 191 R

3740 fills

Q 16

$$\begin{array}{r} 190 \\ \times\ 2 \\ \hline 3)\ 380 \\ \hline 127 \end{array}$$

$$\begin{array}{r} 37650 \\ 700 \\ \hline 20)\ 38350\ (191 \\ 20 \\ \hline 183 \\ 180 \\ \hline 35 \end{array}$$

$$\begin{array}{r} 191)\ 714520\ (3740 \\ 573 \\ \hline 1415 \\ 1337 \\ \hline 782 \\ 764 \\ \hline 18 \end{array}$$

20^c ni

E	187 − 187 = 1240
	183 R
R	$\frac{31400 + 5300}{200}$
C	16

$$\begin{array}{r} 187 \\ 2 \\ \hline 3 \mid 374 \\ 124 \end{array} \qquad \begin{array}{r} 31400 \\ 5300 \\ \hline 2 \mid 36700 \\ 183 \end{array}$$

183) 671160 (3722
5497
1321
1281
406
366
400

21e hi

Emt 195-195 130v

R $\frac{37650 + 700}{200}$

© 16

$$\frac{195 \times 2}{3)\,390} = 130$$

37650
700
20) 38350 (191
20
183
180
35
20
15

191) 748670 (3919
573
1756
1719
380
191
1790

Emf 185185 1235

177R

R $\frac{31400+4000}{200}$

3786 [illegible]

C 16

185
2
3|370
123

31400
4000
2|35400
177

177) 578310 (3786
531
1292
1239
5531
1416
11650
10662
88

177
1239

Emt 194 − 194 1290
194 R

R $\frac{37650 + 2200}{200}$ 3704 ffb.

© 16

$$\begin{array}{r} 37650 \\ 2200 \end{array}$$

$$20)\overline{39850}(199$$

194
2
3)388
129

199)737200(3704
597
1402
1393
900
95
4

Em7 178—178 1170 1840

R 31400 + 5500 / 2000 3294 fields

C 16. 3 178 / 356 / 117 31400 / 13500 / 2) 36900 / 184

184) 606420 (3294
5524
544
368
1762
1676
8666
736

160
172

Clif 180 - 180

120 V

188 R

R $\frac{37650 + 100}{200}$

3393

C 16

$\frac{360}{3} = 120$ 180

20)37750

188)637920 (3393

564

739

564

1752

1692

600

26e Ni

Cut Very high resistance
R
@

Emt 195 – 195 1300
1200 R

R $\frac{37650 + 2500}{200}$

e 16

3243

$\frac{37650}{42150}$ 200

195
2
390

3 | 390
130

200) 74867.0 (3243
486
8
67

Emt 198—198 1335
213 R

R 37650 + 5000
2000

3624 ft lbs

C 16

Bad spot at Clamp

198
396
132

37650
5000
20)42650(213
40
26
20
6

213)772020(3624
639
1330
1278
520
426
970

Ent 183 − 183 122 V
189 R

R $\frac{37650+200}{200}$ 3488

37650
200

C 16 183 200) 37850
3) 366 17
122 16
1

189 189) 659360 (3488
567
923
756
1676
1512
1640

Emt 185 — 185 1235
171 R

R $\frac{31400 + 2800}{2000}$

3919 fr

C 16 185
3)370
123

31400
2800
32200
171

171) 62319 (3919
1072
539
331
171
1600
1539

171
4
39

Ent 178 – 178 119 U

178 R

R 31400 + 3200

200

3632 fl lbs

C 16

178
2
3)356
119

31400
3200
2)34600
173

173) 62733
519
1083
1038
0553
519
440
446

3632

Elut 184 – 185

R $\dfrac{31400 + 33700}{2.000}$

C 16

3874 lbs

Hg in the globe

173) 670210 (3874
519
1512
1384
1281
1211
700
692

33ᵉ Faïtte

Ent 195–193

R $\frac{37650 + 8000}{200}$

C 16

3233 ft lbs

195
193

388

129

37650
8000

20)45650 (2

228 | 737200 (3233
684
532
456
760
684
760

34 C Fe Oct 22

Cu 47 179 - 179

R $\frac{37650+}{200}$ 3337 pllo

C 16

179
2
3 | 358
119

188) 627330 (3337
564
633
564
693
564
1296

188
7
1216

35e D/e

Emt 189 — 190 126 R 208 R

R $\frac{37650 + 4000}{200}$

@ 16 3381 fills

189
379
126

208) 703310 (3381
6244
793
624
1691
1664
270

1235

EM7 185 — 185

R $\frac{37650 + 1000}{200}$ 3472 ft lb

C 16

185 37650
2 1000

$\frac{370}{123}$ 20) 38650 (193
20
186
180

193) 6702.600 (3472
579
912
788
1401
1351
500

193
5
965
4

193
8
44 2

37C Fe

EM7 184 184 123 5
144 C

Q $\frac{31400+5500}{200}$

C 16 3642 ffllb

31400
5500
213640.00
184

184
2
31368
123

184) 6702210 (3642
552
1182
1104
781
736
450

Ent · 190 − 190

R $\frac{31400 + 8500}{200}$

C 16

3590 fils

199) 71 4 5 2 0 (3590

1 1 7 5

9 9 5

1 8 0 2

1 7 9 1

1 0

39e Fle

Clut 185 — 185

31400 + 8500

R 200 3367 fetts

C 16

185
2
3370

31400
8500
39900

199) 670210 (3367
597
732
597
1351
1194
1570

Emf 173 – 175   116 S
158 R

R $= \dfrac{31400 + 200}{200}$ 3772 ft lbs

© 16

$$\begin{array}{r} 173 \\ 175 \\ \hline 3\,)\,348 \\ 116 \end{array} \qquad \begin{array}{r} 31400 \\ 200 \\ \hline 2\,)\,31600 \\ 158 \end{array}$$

$$\begin{array}{r} 158\,)\,596100\,(\,3772 \\ 474 \\ \hline 1221 \\ 1106 \\ \hline 1150 \\ 1106 \\ \hline 440 \end{array}$$

JH
JH

41e Fe

179 − 179 119
174 R

31400 + 3400

200 3606 fl.

16 31400
34000

179 2)34800
2 174
3)358
119

174)627339(3606
522
1055
1044
1130
08

C.M.F. 190 - 190 1270 1700

R $\frac{31400 + 4300}{200}$ 4014 ft-lbs

C 16

$$\begin{array}{r} 190 \\ 3\overline{)380} \\ 127 \end{array}$$

$$\begin{array}{r} 31400 \\ 4300 \\ \hline 2\overline{)35700} \\ 178 \end{array}$$

178) 714520 (4014
712
252
178
740
768

Em7 200 - 200 1880
216

R $\frac{37650 + 4500}{200}$ 3731 fills

C 16 37650
4500

3 1400 / 133 20) 4215 + 210

210) 783620 (3731
630
1536
1470
662
630
320

Elu7 200 − 200

R $\dfrac{37650 + 4900}{200}$ 3696 ft lbs

16

212) 783620 (3696
636
1476
1272
2042
1908
1340

45c ~~1~~ 7e

Aut 180 — 180   1200
184 R

R $\frac{31400 + 5500}{200}$ 3466 ft lb

C

16   31400
5500
2)36900
184

189
3)360

184)637920 (3466
552
859
736
1232
1104
1280

4 b^c

EMF 175 - 175   117

R 31400 + 8000 / 200   3766 fills

C 16

175 / 3350 / 119

31400 / 8800 / 232200 / 161

161) 606420 (3766
4834
1230
1127
1072
966
1060

47c

Eluh 200 - 200

123 U
212 R

Q $\frac{37650 + 4800}{200}$ 3696ft lb

C 16

$\frac{314000}{133}$

37650
4800
20)42450 (22
24
20
4

96
60
24

48 c

Eint 180 - 184   1210

R $\frac{31400 + 3500}{200}$ 3727/lb

C 16

180
184
3.64
121

174) 6456.000 (37.27
522
1266
1218
480
348
1320
88

EMF 202 - 202

Q $\frac{37650 + 7000}{200}$ 3567 fills

C 16

Carbon has a bad

color.

$$\begin{array}{r|l} 223 & 795450 \; (3567 \\ & 669 \\ \hline & 1264 \\ & 1115 \\ \hline & 1495 \\ & 1338 \\ \hline & 1570 \\ & 1561 \end{array}$$

Emt

181 — 181 1915

31400 + 2700

2000 4412 p lb

R

C

16

147) 648600 (4
441
07

147 (648600 (4.412
588
606
588
180
147
330
294

	Volts	Ohms	Ft lbs
1 ✓	111	154	3500
2	145	222	4195
3 ✓	126	158	3730
4 ✓	126	189	3721
5 ✓	122	189	34[illegible]
6 ✓	128	209	3473
7 ✓	128	204	3552
8 ✓	127	206	[illegible]
9	123	12[illegible]	3384
✓	135	159	5077
11	123	188	3564 ✓
12 ✓	129	195	3780
13 ✓	115	159	3681
14	115	155	3779
✓	138	210	4017
✓	132	220	3509
17	130	188	3928

Valts

38	127
39	123
40	116
41	119
42	127
43	133
44	133
45	120
46	117
47	133
48	121
49	134
50	121

18	133	223	3514
19	127	191	3740
20	124	183	3722
21	130	191	3919
22	123	177	3786
23	129	199	3704
24	117	184	3294
25	120	188	3393
27	120	200	~~3343~~
29	122	189	3488
30	123	171	3919
31	119	176	3632
32	123	173	[illegible]
33	129	228	3233
34	119	188	3337
35	126	208	3381
36	123	193	3473
37	123	184	3642

20 cell

$\frac{101.5}{20 \times 1.18} \times 419$

2.0064
9.9666
8.6990
.6710

4.7

9.3290
2.6222
1.9512
1.9512
1.6464
7.6830
3.2318

Test of lamp No 37

Batteries 50.5 L
51 R
101.5

1 Candle

209 L 89.4 Volts
210 R
419

37650
3900
41550
207.75 Ohms

1706. Ft.lbs.

9.3290
2.6547
1.9637 96.?
1.9637
1.69?4
7.6920
3.3058 2022

2 candles

225 L
227 R 225 / 226.5 / 4515 96.3 volts
225 L
226
37650 20.22 Ft. lbs
3000
(40650
203.25 Ohms

9.3290
2.6875
2.0165
2.0165
1.6464
.7010
3804

3 candles

242 L
245 R
487

3 1/3 candles
103.7 Volts

37650
22250
39900
199

199 ohms

Batteries 51.5 R
50 L
101.5

240 ft lbs

~~9.3290~~
~~2.6946~~
~~2.6~~

9.3290
2.6946

2.0236
2.0236
1.6464
7.7051

3.3987

Batteries Lamp adjusted

49.5 L
52 R
240 R from 3 candles

10 1.5

105.5 Volts

4 candles

~~245 L~~ good
248 R
247 L
495

37650
1800

39450
19725 Thus

2505 ftlbs

9.3290
2.7110

2.6400
2.6400
1.6464
7.7062

3.4326

5 candles

257 L 1095
256

.258 R
514

37650
1700 2707.5

39350
196.75 Shaw

9.3290
2.7259
2.0549
2.0549
1.6464
7.7122
3.4684

1131.3

7 candles

265 L
267 R
532

113.3 Volts

37650
1150
3)8800
194. Ohms

2940 ft lbs

9.3290
2.7443

2.0733
2.0733
1.6464
7.717B

3.5103

9 candles

275 L

275 R
272 L
276 R for
37650
800.

8½ candles?
9 candles
279 R
276
555

118.5

276
279

37650
700

38350

191.7

3239 [illegible]

6 17
.8
.025
.3 2
.300 .050

017
.008
.025
.050
.3

100:832:.300
83
249
684
708.9 .300
.21 26.7

800
12
9600

.212
800
169.600
64.8

9.2 makes samuel tonkin

8.329.0
.7559
.0849
.0849
6464
7207
5369

11 candles

285
285 R
285 L
570
37650
400
38050

121.50

344 = fills

3290
7712

1006
1006
6464
7258

5734

14 candles

294 L
297 R

591

.1261 Volts

31400
6200

13.7600
188.

3743 ft. lbs

3290
7810
1100
1100
6464
7276
5940

16 1/4 candles

296 – 297   15 3/4 ÷ 7

16 candles

300 L
302 – 306   300
             304
             604

31400
60550
37450
187.25

128 Volts
3926 ft. lbs

3290
7860
1150
1150
6464
7312
6076

1815 candles

306 R
305 L
6 "

130.5

31,400
5750
37150
18575

4051

3290
7983
1273
1273
64.64
7364
6374

4340 ft. lbs.

2½ mulles

315 L
316 R
310 L

316
312.5
628.5

31400
5300
36700
183.5

1341 volts

4340 ft. lbs

27 candles

323 L

332 R 30 candles

31400

5000 27 candles

To 4800

33 candles

325 L

31 candles

325 L

330 R

325-336 L

3290
6998
0288
6258
6464
7089
4129

5 candles

24.9 L
252 R
501

106.8 Volts

31400
7700
391.00
195.5

2588 ft lbs

3290
7404
.0694
.0694
6464
7212
5064

9 candles

272 £

277-276

275 £

273.5
272.5
5500

31400
6600
38000
190

3209

3290
7582
0872
6872
6464
7258
5466

12 1/4 candles

284 L
284 L
289 L

284
289
573

122.4 Volts

31400
6200
(37600
188

3520

3290
6160
9450
9450
6464
6840
22 04

1 candle

205 L
2
413

31400
10000
141.400
207.00

Batt.
48.5 L
51.5
1010

88.2 Volts

1661

Corrected curve

Candles		Ohms	Volts		
1		207.5 ✓	89.4 ✓		
	4.25	203.25 ✓	96.3 ✓	6.9	
2				6.7	
	3.65	199.6 ✓	103 ✓		
3	2.1		106 ✓	3	
4		197.6 ✓		2.9	
5	1.5	196.1 ✓	108.9 ✓	2.7	
6	1.3	194.8 ✓	111.6 ✓	2.4	
7	1.1	193.7 ✓	114	2.2	
8	1	192.7 ✓	116.2 ✓	2.0	
	1	191.7	118.2 ✓	1.7	
9	.7	1910	119.9		
10	1.4 .7			1.55	3.1
		189.6	123	1.5	
12	.7	188.2	126	1.2	
14	.6	187	128.4	.8	
16	.55		130.3	.8	
18	.6	185.9	132.1	.8	
20	.45	184.7	1338		
22		183.8			

89.4 9513
9513
6464
6830
1701
2320

1

9836
9836
6464
6920
2021
3056

2

6128
6128
6464
6998
2356
3718

3

106 0253
0253
6464
7048
197.6 ~~3425~~ ~~2426~~
4011 2518

4

108.9 0370
0370
6464
7075
196.1 4279 2678

5

111.6 0469
0469
6464
194.8 7104
4506 2823

6

114 0569
0569
6464
193.7 7129 2972
4731

7

116.2 0653 8
0653
6464
192.7 7152
4921 3105

118.2 0726 9
191.7 0726
6464
7175
5091 3230

119.9 0751 10
191 0751
6464
7190
5156 3278

0788
0788 3334
6464
7190
5230

123 0899 12
0899
6464
189.6 7271
5483 3535

126 1004 14
1004
6464
188.2 7253
5725 3738

128.4 1086 16
1086
6464
187 7282
5918 3907

130.3	1149	18
	1149	
185.9	6464	
	7307	
	6069	4045

		20
132.1	1209	
	1209	
184.7	6464	
	7336	
	6218	4186

		22
133.8	1265	
	1265	
	6464	
183.8	7357	
	6347	4312

51 e

210 – 210 140 Volts

$$\frac{37650 + 1400}{200}$$ 195

16

37650
1400
20) 39050 (195
20
180

250
2
3 | 500
166

227 — 227

227
227
454
151 Volts

07650 + 1400
200
195

16

Blue at the Clays

37650
1400
20 | 39050 (195
38
190
180
10

52e

Note with Lamp (Welded
nickel No 3

120 Volts

180 - 180

$$\frac{25150 + 53000}{2000} \quad 152$$

16

$$\begin{array}{r} 25150 \\ 245 \quad 5300 \\ \hline 200\,)\,30450\,(\,152 \\ 200 \\ \hline 1045 \end{array}$$

54 c

$\frac{430}{143}$ Volts

215 — 215

37650 +

20 Y

430

$$
\begin{array}{r}
37650 \\
4000 \\
\hline
20\,)\,41650\,(\,208 \\
40 \\
\hline
1
\end{array}
$$

note with [illegible]
[illegible] [illegible] [illegible]

190 − 190

$$\begin{array}{r} 190 \\ \underline{100} \\ \underline{\smash{)}\,740} \\ 123 \end{array}$$

$$\frac{31400\ +}{200} \quad 157$$

16

576

$\frac{470}{153}$ Volts

$$\frac{37650 + 7500}{200} \quad 225$$

16

$$\begin{array}{r} 37650 \\ 7500 \\ \hline 20\overline{)45150} \\ 40 \\ \hline 51 \\ 40 \\ \hline 115 \end{array} \quad 225$$

207 — 207

444
134 Volts

37650 +
200

188

Blue at the clamp

200)37650 (188
200
1765
1600
1650

✓

58

Note (machine no. 5)

$$\frac{1396}{132} \text{ volts}$$

198 — 198

$$\frac{31400 + 2000}{200} \quad 167$$

16

Bluecoat Checkoff

$$\begin{array}{r} 31400 \\ 2000 \\ \hline 2\,)\,33400 \\ 167 \end{array}$$

5 9e

198 — 198

$\frac{396}{132}$ Volts

$\frac{31400 + 7000}{200}$ 192

16

$$\begin{array}{r} 31400 \\ 7000 \\ \hline 2\,\big|\,38400 \\ \hline 192 \end{array}$$

60 c

Note (No 2 Machine)

205 205 $\frac{410}{133}$ Volts

$$\frac{31400 + 3000}{200} \quad 172$$

$$\begin{array}{r} 31400 \\ 3000 \\ \hline 2)34400 \\ 172 \end{array}$$

61 c

Mule (No 8 Nickle)

217
218
435
145

217-218

$$\frac{37650 + 2000}{200} \quad 198$$

16

Blue at the clamp.

37650
2000
20) 39650 (198
2
19
18
16
16

134 :: 154 :: 195

2900
1875
8729
3504

+ 22.4 ohms

62c

202-200

(404
134 Volts

$$\frac{37650 + 1500}{200} \quad 195$$

16

37650
1500
2)39150
195

20)39150(195
190
115

63 e

205 - 205

$\frac{410}{136}$ Volts

$$\frac{31400 + 35000}{2000} \quad 174$$

1.6

31400
35000

2 | 349 00
174

205
2

3 | 410
136

136 : 154 :: 174

2405
1875
8665

2945

197
174
23 Ohms

64 @

222 - 222

37650 + 7000　146

200

223

$$\begin{array}{r} 222 \\ 3\,\overline{)\,444} \\ 146 \end{array}$$

1/6

2　2

37650
7000

20 4 4 6 5 0 2 2 3

40

46
20

65 ©

200 – 200 133

$$\frac{37650 + 2500}{200} \quad 200$$

16

$$\frac{2,400}{133}$$

37650
2500
2240150 (2.0

133 : 154 :: 200 :

3010
1875
6761
3646 +

231 1/2
200
31 1/2 Ohms

66e

190 — 190   126

$$\frac{31400 + 50000}{2000}$$ 121

1 6

$$\begin{array}{r} 314\cancel{0}\cancel{0} \\ 50\cancel{0}\cancel{0} \\ \hline 3)364 \\ 121 \end{array}$$

67 e

$215 - 215 = 143$

$$\frac{37650 + 7000}{200} \; 223$$

$$\begin{array}{r} 215 \\ \underline{2} \\ 3\overline{)430} \\ 143 \end{array}$$

16

$$\begin{array}{r} 37650 \\ \underline{7000} \\ 200)\,44650\,(223 \\ \underline{400} \\ 46 \\ 60 \end{array}$$

6ge

190 – 190   126

$$\frac{31400 + 5500}{200}$$ 123

16

31400
5500

3|36900
123

69e

190 — 190 1260

31400 + 157R

200

16

192

3|380

126

2|314

157

Tested the Elect
of the light Arc
for Mr Brackner.
Elect 140

70 C

184, 184

$$\frac{25150 + 5700}{200}$$

16

184
2
368
123

25150
5700
30850
154.25

123 ; 154 :: 154.25 :

2.1875
2.1875
79104
2851

192.7
150
38

+ 38 ohms

71c

mekke no 2

213 - 215

$$\frac{31400 + 6700}{200}$$

16

72 e

Meter no 1

204 − 200

31400 + 5500

200

31400
5500
36900 18450

1.34 : 154 :: 184.5

202
200
402
134 Volts

1894
2659
8799
3342

215
184.5
+ 30.5 Ohms

Stop here to test Dr
Nickels meter.
leading wires .33 ohm
with meter 2.85

2.85
.33
2.52 ohms.
This was when
I was in [illegible].

78c

~~Spark experiment~~

228 - 228

$\frac{37650 + 1500}{2}$

228
228
456
152

16

37650
1500
39150
19575

152; 154; 195.75;

2916
1875
8182
2973

198
195.75
2.25
+

2 1/4 Ohms

75 C

Nickel No 2

195 − 195

195
195
390
130

31400 + 3700

2000

16

19

31400
3700
35100
17555

190 : 154 : 175.5 :

2[illegible]
1[illegible]
8861
316.6

201
1755
+ 255 Ohms

Mekle no 2

$$\frac{37650 + 40000}{2000}$$

16

$$\begin{array}{r} 37650 \\ 4000 \\ \hline \end{array}$$

$20 \overline{)\,41650\,}(208$

40

1

77e

Nickel A02

140

210 - 210

$$\frac{37650 + 4500}{200}$$

16

37650
4500
42150
210.75

140 : 154 :: 210¾ :

3237
1875
8539
3651

232
210¾
+ 21¼ Ohms

$$\begin{array}{r} 238\tfrac{2}{2} \\ 3\overline{)476} \\ 158 \end{array}$$ 2¢

Nov. 9

Camp put them at this day at 8.30 in the night.

74¢ lasted. 10.9 o'clock

56¢
~~6~~5¢ Nov. 12

8¢

~~24~~¢

10.10.32 Nov 9 1

Meter Check at

9.53.

(10.3'.32"

10.

10 27 21
10 15 7
12 14

10. 3 32
9

10 3 32
10 15 7
25

8

10 1.5 67
10 3 32
11. 35

9

10 53
9.5 ~~3~~

~~10 53~~
10 63 32
9.5 3
10.32

six

10.15 .7
10 3 32
11. 35 live ...

10.15' 7"
10. 27 21
12. 14

Right

50
32
311

10 39 21
10.27 21
12.0

Left

10 39 21
12 14
11 35

10 51 20
10 39 21
11. 59

Right

80
50
21
59

51 20
12
63:20

11.15 26
11 5 9

26 85
27 60
25

62
20
42

63
51
12

11 27 25
12 4

39 : 29

62
51
11

3 22
11 5 9

14 81
60

15 : 21

75
20
59

10 15 7
10 . 27 21
12 . 14 } Right

10 39 21
10 27 21
12' } left

10 51 20
10 39 21
11 : 59 } Right

11 3 22
10 51 20
12' . 42" } left

11 15 . 26
11 3 22
12 4 } Right

11 27 25
11 15 26
11 59 } Left

11 39 33
11 59

50 92
56 32

50 20
39 62
11 52
33
49

11 39 33
11 27 25 Right
12 8

51 22
11 39 33 Left
11 49

2.17609
2.17609
1.64640
7.62343

3.62201

4170 ft lbs

78^e

37687 × 80.800

225 ——— 225

37687
10000

2)47687

238 Ohms

(e)

16

22~~8~~

225

450

150 Volts

126
126
756
252
126
15876
44.3
47628
63504
63504
70330.6

3868)33000(85
3088
2120
06
30

182)703306(3.860
5466
1573
1456
1170

~~4~~c 79c

190 + 190
31406 + 5000
200
16

1.90
1.90
3.80
1.26 Volts

31406
5000
36406
1.2 Ohms

[illegible]

190 - 190

31406 + 4300

16. 178 [illegible]

197 – 197

$$\frac{37687 + 4500}{200}$$

16

203-205

37687+27000

16 = 28

192 — 192

37687 + 7500

16 1756 [illegible]

84^e

210 - 210

37687 + 5000

16 223 [illegible]

85 ©

191 191
37684

16 188 chms

86e

202 — 202
37687+ [illegible]

16 203 [illegible]

192 – 192

31406 + 480

16 179 Sheets

195 — 195

37687 + 3000

16 203 ohms

89

185 - 165

31406+3700

16 175-

90 e

195 – 196

37687 + 2000

16 198 [illegible]

207 - 207

37640
2406
240 | 40 ~~120~~
208

36840
2840
240 | 39 ~~680~~
298 . 240

36680
3604
240 | 3828~~4~~
291

35687
4680
~~240~~ | 40367
201

5608
3807
5680
240 | 14095
70

46407
6032
4041
5862
5234~~2~~
261

15 klef 1 [illegible]
13 2 [illegible]
120 Tread [illegible] 150
current broke on [illegible]
0 klef
110 klef
122 klef
126 klef
123 klef
122 klef
0 klef
~~160~~ sample [illegible] 750 klef
160
168
170
160
164
0 klef
150 klef
0 "
105 "

~~480~~ 139 2

162 2

3 | 324

108

3 | 278

92 $\frac{2}{3}$

322 2

360 | 644

214

4 1440

2

120 2

3 | 240

80

2880 .406 420

8421

17280

139 2

3 | 378

129

3

57.840 2

183680

148 2

3 | 296

98 $\frac{2}{3}$

4083 4062 3041

147 2

3 | 294

98

2

11196

5598

142 2

3 | 284

94 $\frac{2}{3}$

130 2

3 | 260

86 $\frac{2}{3}$

86

Second Test —

2 ohms 2 ohms

142 deg. 2 ohms

139 deg. "

142 " "

130 "

0 deg.

3780
4760
3268
4832

4760
3210
17976
39

17540
87
870

75680
2224
797

22244

7600
3042

3726
3296

50726
2542

4680
3242

47580
21120
57328
25242

1215
3604

91©

204,204,

37687 + 2500

16

200 198

37687 + 20000

16

215 – 215

37657 + 10000

16

94° mallenol

~~180 – 180~~ 182 – 182

31406 + ~~4000~~

16

200 - 2000
37687+1500

16

202 - 202

37 687 + 4 two

16

97C

200 - 200

37687-16000

16

Bussed [illegible] with
very [illegible] [illegible]

180 - 180

31406 + 2000

16

~~106~~
106

175 - 175

31406 + 400

16

187 – 187

37680 + 1700

16

44

$\frac{1044}{956}$

44 : 956 :: 1 :

44)956(21.
88
76
44
320

1.00e

175 −175
31406

16

194-194

37 687 + 3000

106

X

195 - 198

37687+1700

16

217 – 217

37687 + 9000

16

103c

220 - .279

37687 + 1000

16

104^e

to high R

$$\frac{(BC+CE)(AB+EA)}{BC+CE+AB+EA} = \frac{BC.AB.CE+BC.AB.EA+CE.EA.BC+CE.EA.AB}{BC.CE+AB.CE+BC.EA+AB.EA}$$

$AB.BC+AB.CE$
$+BC.EA+CE.EA =$

$BC = a \;,\; CE = b \;,\; AB = c \;,\; EA = d \;,$

$$\frac{(a+b)(c+d)}{a+b+c+d} = \frac{ac}{a+c} + \frac{bd}{b+d}.$$

$$\frac{(a+b)(c+d)}{a+b+c+d} = \frac{ac(b+d)+bd(a+c)}{(a+c)(b+d)}$$

$$(a+b)(c+d)(a+c)(b+d) = ac(b+d)^2 + bd(a+c)(b+d) + ac(a+c)(b+d) + bd(a+c)^2$$

$$2abcd = a^2c^2 + b^2d^2.$$

105 e

too high R

$$\begin{array}{l} a+b \\ c+d \\ \hline ac+bc+ad+bd \\ a+c \\ \hline a^2c+abc+a^2d+abd+ac^2+bc^2+adc+bdc \\ b+d \\ \hline \end{array}$$

abe abe

ceea

$be^2 = = bee$

$$X = \frac{(Be + Ce)(aB + Ea)}{Be + Ce + ab + Ea}$$

$BC.AB(CE+EA)+CE.EA(BC+AB)$

$$\frac{AB \cdot BC + AB.CE + EA.BC + EA.CE}{BC + CE + AB + EA} =$$

$$\frac{AB(BC+CE) + EA(BC+CE)}{(BC+CE)+(AB+EA)} = \frac{BC.AB}{BC+AB} + \frac{CE.EA}{CE+EA}$$

$(B + CE)(AB + EA)$

205

205 205

37600 + 1000

16

$Be + ce$
$ab + ca$

$ab^2c + abce$
$Bcea + ce^2a$

$ab^2c + 2abce + ce^2a$

$Be + Ce + ab + ca$

4 $\quad \dfrac{32}{\frac{5}{160}}$

$\dfrac{5}{9}7 \quad \dfrac{57}{9} - \dfrac{160}{9} = 45 \quad 4$

$$\begin{array}{r} 45 \\ 9 \\ \hline 405 \\ 160 \\ \hline 565 \\ 113 \end{array}$$

$$\frac{ab}{bc}\qquad \frac{ce}{ca}\qquad e^2ca$$

$$\frac{ab^2c}{bc+ab}\quad \frac{c^2ca}{}\quad \frac{ce}{ca}\quad ce^2ca$$

$$\frac{ab^2c}{bc+ab} + \cancel{c^2a}\ \frac{ce^2a}{ce+ea}$$

$$\frac{abc}{c+a}\quad \frac{cea}{c+a}$$

C
O
N
H
Cl. 70 ✓
Fl. 76 no ∂
Br 72 ✓
S. 74 ✓
P 75 ✓
Si 77
B 82 ✓
Sel 65 ✓
g. 63

675

Menlo Park Notebook #176 [N-80-00-07]

This is the third of three notebooks that contain the results of a search, conducted by Otto Moses during the summer of 1880, for literature relating to the electric light. (See also Menlo Park Notebooks #127 and #128.) The citations are listed in alphabetical order by author. There are two sets of listings, beginning on pages 2 and 88. The book contains 284 numbered pages.

Blank pages not filmed: 98-284.

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Journ. de Phys. LXXV., 1812 .. 45-55

" Experiments on the action of different gases on quicksilver, without raising their temperature.
Schweigger, Journ. IV., 1812. 393-409

" On the influence of traces of foreign metals on the electric conductivity of quicksilver &c.
Pogg. An. CXVI., 1862.. 369-392.

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Wagenmann, C., 4

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Walker, Chas. V., 26

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Loop Clamp Meter Some observations on the resistance which electric currents experience in passing from solid conductors into liquid.
Bibl. Univers. Archives, 1., 1841.. 539-554.

Vacuum On the distillation of photogine, and paraffin oil in vacuo.
Dingler Poly. Journ. CXXXIX., 1856.. 43-48

Mercury. Observations on the state of mercury and mercurial ointment and other preparations made by triturating mercury with different substances.
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Roy. Soc. Proc. IX., 1857-59.. 628-633

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Waltenhofen, A. von., 3

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Ward, Wm. S., 6.

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Bamboo Fibre On the Bamboo and Durian of Borneo. Hooker, Journ. Bot. VIII, 1856.. 225-230

Mercury On the colored films formed by iodine, bromine and chlorine upon various metals.
Phil. Mag. XXI., 1842.. 426-437.

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Pog. An. CXVII., 1862.. 606-610

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Roy. Soc. Proc., V., 1849.. 855-856

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Phil. Mag. XXV., 1844.. 546

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Archives de l'Electricité II., 1842.. 596–600.

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Lausanne, Bull. Soc. Vaud., II., 1846.-48., 341-353.

[Does induction affect the acoustic qualities or properties of elastic bodies.
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Majocchi An. Phys. Chem. XXVII., 1847.. 54-56.

[Description of an apparatus destined to establish immediate correspondence between any two stations on the same tel. line
Bibl. Univers. Archives XXIII., 1853. 5-24]

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φ –. for voltaic electricity.
Phil. Mag. V. 1853.. 12-16

Governor Description of a voltaic compensator
for maintaining a constant intensity
in any pile.
Bibl. Univers. Archives, 1, 1858.. 26-32

[Notice of a process by means of which
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Phil. Trans. ~~XXXIII~~: 1833.. 333-342

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Phil. Mag. VII., 1835. 107-113

" On electro-magnetic motive machines.
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Chemist, I., 1840., 4.

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Pog. An., LXI., 1844.. 431-448
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Electro dynamic measurements.
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Meter On the construction and use of an instrument for determining the value of intermittent or alternating electric currents for purposes of practical telegraphy.
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" On the streaming of liquids from the
Loop positive to the negative pole of a closed
carrying galvanic circuit. (see 7 & 9 & 12
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Photo-metry. On a new photometer &c.
Pog. An. XCIX., 1856.. 235-274

A Light Clamps. Experiments on an explanation of a unipolar heating in the galvanic arc.
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Schweizer Gesell. Verhandl. XLVI., 1862 .. 107-108

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India, Journ. Agr. Soc., VIII., 1854 .. 182

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do., 1, 1842 .. 369-384

Vacuum Mercury. Mercurial safety valve.
Cornwall, Polytechn. Soc. Trans., 1840 .. 54-55.

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Hooker, Journ. Bot. VII., 1855. 335-340

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Nicholson Journ. XI., 1805. 110-111]

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Dingler Polytech Journ. CLXXXIII 1862. 188-190.

[A method of finding the specific gravity of light from analogy &c
Nicholson, Journ. XIX., 1808. 143-146]

Witting. Ernst, 3.

Wollaston, Wm H., 53

Woods, J., 9

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Kastner, Archiv. V., 1825.. 329_332

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Marburg, Ges. Naturw. Schriften, II., 1831.. 205-211.

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" Remarks on the depression of mercury in glass tubes. (Signed S. B. L.)
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Liebig An. LXXV., 1850, 53-94

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Venezia. Atti., II, 1857.. 205 207

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Gehlen, Journ. VI, 1808.. 306-321.

Glass Pumps. Simplification of glass stopcocks.
Trommsdorff. Journ d. Pharm. XVII., 1808.. 64-68.

Photo-metry Photometric observations.
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do., CI, 1857.. 139-143.

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Borel, —

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Tilloch's Phil. Mag. XLIX., 1817.. 197-199.

Vacuum On the production of ozone.
Deutsch. Naturf. Versamml. Bericht, XXXIV., 1858.. 168-169.

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Vacuum Who first observed the peculiar odor [illegible] electrolysis which lead to the discovery of the active state of oxygen?
Frank. Jahresb. Phys. Ver. 1856-57.. 32-34.

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Meter Memoir on the relations between the conducting power of liquids for electric currents and the chemical decompositions which they undergo.
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Glass On electrical dust figures observed on plate Vacuum glass.
Phil. Mag. I. 1851. 43-44.

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Bologna. Mem. Acad. Sci. III., 1863. 301-319.

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Henley, Wm.

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Jacobi, M. H., 49

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Lond. & Elect. Soc. Proc. 1837-40.. 183

Meter. Remarks on the originality of Dr Faraday's Volta-electrometer.
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Conducting power of iodine for electricity.
Phil. Mag. IX., 1836., 450-452.

Dynamos.. On the application of electro-magnetism as a motive power in navigation, and on electro-magnetic currents.
Phil. Mag. XV., 1839.. 161-165.

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Halle, Jahrsb. Nat. Wis. Ver. IV., 1851.. 13-14]

Dyna. Considerations on the difference existing
mos. between the electric force of steam and electro-magnetic force, and its application to motors.
Il Cimento III., 1845.. 225-234

A. Light On the influence of magnetism on the voltaic arc.
Halle, Jahresb. Nat. Wis. Ver. II., 1849-50.. 3-4.

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Majocchi, An. Fis. Chim. IX. 1843 - 282-284

Mercury Oxydation of quicksilver.
Scherer, Journ. Chemie, II, 1799.. 742-743

Production of a galvanic copper deposite on cotton cloth
Schweitzer. Gesell. Verhandl. 1846.. 40-41

Loop carrying On the movements which present themselves in a galvanic circuit at the places where the conductors touch each other very lightly.
Lausanne, Compt. Rend. Soc. Suisse, XLV., 1861.. 34-40

On the electricity developed in mercury by filtration.
Majocchi, An.

Globes. On the exhalation of bicarbonate of ammonia by the lungs.
Phil. Mag. XXX., 1847.. 124-125

Menlo Park Notebook #177 [N-79-03-00]

This undated notebook was used by Francis Upton to record references to generators found in Menlo Park Notebooks #1-#13 and #15. It probably dates from 1880 or 1881. The label on the front cover is marked "Note Books" and "Index Machines." The book contains 282 numbered pages.

Blank pages not filmed: 42-282.

Book 1 page 25

Tuning fork machine good drawing Dec. 15, 1878.

Page 27 plan connections magnets

P. 29 same

31 ~~Drawing~~ Tuning fork machine

33 length vibration tuning fork

35 Train of gears to run dynamo dated Dec. 17. 1878 sizes given and machine partly drawn

37 form machine

Book 1

Various forms Dec. 26, 1878.

45 — 52

Faradic testing machines

to discuss laws page 53

p. 54

90 – 97 various diagrams

of currents from magnets

pages ~~104~~ 102 107 figures on

gears.

p. 111 diagram

113 Wheatstone bridge of

magnetism

March 12

Book 1, page 121 – 125

The discharge from a magnet measured by means of sounder. Armature on the magnet tried and then removed and the discharge was found to be stronger sharper and shorter.

page 131 Figure of armature

Book 1 Page 137–153

Tests of man power

Book 1 p. 219 – 223

Figures as to dimension magnets

Also p 232 laws concerning economy

Page 245 Table of resistance armatures

10 Ohms	316 turns
5 "	223 "
4 "	200 "
2 "	141 "
1 "	100.
&c	&c

page 246 "picture" long magnet.

248–249. figures relating to resistance

Dated Pearl Street 7 March '79

Book 1 page 254 — 257

Plans of connections for testing wire when hot

No date

Book 2 page 9-11 Switch for Wallace machines Dec. 10, 1878.

Book 2 p 13 Tuning fork dynamo Dec. 10

Book 2 p 15 Tuning fork dynamo plan of steam cylinder and magnets. Dec. 10

p. 16 direction Dec. 11

p. 19 Gramme machine commutator current plan.

Dec. 20

page 21 when the internal resistance of magnet equals external best effect. Edison

Book 2 page 23—25
Gramme machine diagram
p. 27 Gramme with rotating
magnets
p. 28 Ring and magnets ro-
tating
to Page 72 various dia-
grams of magnets and
line of force undated
On page 75 date of exs in
bringing up spirals by battery
Feb. 8, 1879
Gramme machine used on
spirals page 85 resistance
in line with spiral which
measured cold .73 ohm
and had in line with it
D.K. about 4 ohms

Book 2 pp. 90-91

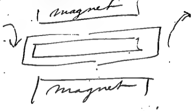
Ends armature Edison's first magneto
Book 2 p. 149
Date Mac Laughlin return from the Chaudiere river June 6, 1879,
Picture of machine immediately following this
Two binding posts at the base
Book 3 from p 73-81 undated diagrams of magnets
Date near this March '79
Book 3 p. 143-150 ~~comm~~
Date Jan 12-15, 1880
Commutator drawing by Mr. K
to page 177 a number of undated drawings of magnets and machines

Book 4 p. 33 No date
drawing resistance coil
Book 4 p ~~39~~ 41-45 no date
counter shaft for running Gramme
at various speeds
Immediately after date.
Jan 22 1879

Book 4 Page 77 — 105
Feb. 15, 1879.
Edison's magneto electric machine Account of Exs to get
current speaks of putting
a battery and the Gramme
machine on the magnets
and obtaining an arc.
refers to
Book 7 pp. 169-175
9 " 181
28 " 1-81

Book 4 P-117   Feb. 18, 1879

Diagram machines
On page 123 is the won-
der where disks are revolved
in the opposite directions so
as to take in all the lines of
force —



To page 145 various diagrams
undated of machines and magnets.
after these Page 147 Feb. 19, 1879
account of Exs on magnets.
Where the current of the
Gramme was put on the
Edison and the Edison
on the Gramme to see
if the machine turned
harder.

Book 4
Page 155 Date Feb. 19, 1879

Battery put on Gramme and the ring run. Three iron wires heated four feet long

Gramme on Edison

Page 159 Feb. 20 1879
Suggestion as to opening one side of Gramme to run Jablochkoff.

Page 182-185 No date
Directions for making boxes for resistance
Immediately after date
March 10, 1879.

Book 4 page 280, 282
no date
Diagram connection

Book 5 Nothing

Book 6 p12 ~~Extract~~ No date
Estimates concerning the power required to drive the Wallace machine

Book 6 p 21-39 No Date
Various estimates as to Gramme efficiency and diagrams of magnets and coils

Book 6, Page 47-51 No date
Estimate capacity Gramme
Notes of various experiments
No dates. ~~followed by date of Jan 30, 1879~~ where the Gramme was used to bring up wires. followed by date of Jan 30 1879

Book 6 no dates to.
a large number of calculations
as to distribution, cost, and
diagrams of no great importance.

Book 7, page 9. Dec. 13, 1878.
attempt at non commutator

Book 7 page 23 Dec 17 1878
T.A.E.

De Meriten form of dynamo
machine showing a powerful
~~to~~ magnet.

page 25-27 Dec. 17. 1878
various forms of

page 31 Dec. 17, 1878 T.A.E.
Small Gramme for Telephones

page 33-60 Dec 17, 1878
Various forms of dynamos
and especially the early
drawings of Edison's first

Book 7, page 61

Dynamo machine Dec. 29, 1878

Full drawing of ~~E~~ Edison's first machine.

Sketches follow this by Batch

pages 62 – 138 Under dates Jan 1 to Jan 7 are various sketches of the loops of the Gramme and the Siemen's machines showing how they are related and and a number of attempts to commutate the currents from a series

Page 139 Jan. 7 1879

Drawing for resistance box.

Page ~~147~~ 149 Jan. 7, 1879.

Book 7

The iron lamp
is shown on page 151.
Date Jan, 9. 1879 F. H. E.

From page 169-213 Jan 9- Feb. 15
a large number of devices
for commutating currents
and the ~~devices for~~ di-
agrams of connections for
the Edison dynamos.

Book 8 Faradic machines
Page 13 Dec. 20. No. 1.
Test machine for driving ~~machines~~

Pages 80 to 138 a large num-
ber of tests of the Gramme
machine showing the relation
between the strength of current
and the E. M. F from the
armature.

Book 8.
Page 138-175 May 10, 1879
Tests of the Edison machine

Page 176 Speaks of the
magnets being quantitized
and the coils connected by
threes this was for the
Jeannette
Date soon after of June 9, 1879
Under date of June 10, 1879.
is mention New machine Gramme
on magnets and after that
follows some tests showing
relation between current on
field and E. M. F from
armature
June 11, New Machine on
its own field
Rest of book Test from June 11

to June 13 showing
relation of field to
the E. M. F. of the armature

Book 9 pages 5–13 Dec 15 '78
Dynamo Mac T. A. E.

Book 9. page 25–29 Dec. 16 1879.
Dynamo mashines

Book 9. p. 49–75 no date
machines
page 77 Wheatstone bridge
for magnets
page 77 — 109 no date
magneto devices
Then date Jan. 14, 1879
145 — 155 no date
magneto devices

Book 9 page 175
Feb. 16, 1879

Gramme ring electric en

page 181-211 Diagram of connections Feb. 15, 1879
for commutating

Book 10 from pp 96-end full of drawings for testing the theory of magnetism and also sketches for Edisons first magneto.
Dec. 16, '78 to Jan. 1, '79

Book 11

p. 13 Non commutator no date
15 Lines of force " "
19 Non commutator Dec. 28, 1878.
21–29 -- ——— no date
31 Faraday's magnet no date
37 Magneto machine no date
details

82–~~83~~ Split ring Gramme
Feb. 20, 1879.

83 Winding Siemens Feb. 20, 1879.

84–85 Non commutator Feb. 20, 1879.

86 Remark "Remove the commutators and make the Gramme give off any current that may be required from it." Feb. 20, 1879.

87–89. Non commutator

95–100 Edison's Dynamo Feb. 17, 1879

101–110 Non commutator Feb. 1879.

110–127 ——— ———

Rest of book no date and only attempts at non commutator at intervals

Book 12

p. 3 attempt Non comm — No date
5-9 Exs. on friction using a magnet to take off the weight. Dec 20, 1878.
11 Gramme machine balanced with battery. no date
13-69 Non Commutators No dates.
86-87 I final brought to [illegible] Jan 10 1879

No dates
Estimates of lamps
attempt noon commutator

Book 13

Book 15

p. 47-5 Large ring machine
March 9, 1879

89 Mr. Edison speaks of
experiments with small
dynamo. March 5, 1879.

Menlo Park Notebook #179 [N-80-00-02]

This undated notebook was used by Francis Upton to record notes and calculations about the lamps needed for the steamship City of Rome. It probably dates from 1880. The book contains 284 numbered pages. Only one page has been used.

City of Rome ← (Steamship) 1

~~How Staterooms lights~~

~~on lower deck~~

16 candles

59 lights 16 candle power ~~on lower~~

30 " on upper deck

16 " promenade

105 of 16 candles

25 Engine room

130

8 candles

74 on upper of eight

64 in saloon

137 lower deck

275 lights of 8 candles

20 in passage ways

295 8 candles

130

425 lights in all

50 HP Engine

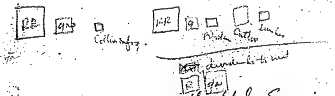
Menlo Park Notebook #184 [N-80-06-16.1]

This is one of six notebooks that were probably begun on January 10, 1881. It is a draft of a proposed book by Edison to promote his system of electric light and power distribution as a replacement for gas lighting. (See also Menlo Park Notebooks #187-#191.) The label on the front cover is marked "Prospectus Book." The spine is stamped "Edison's Prospectus Book." The book contains 284 numbered pages.

Blank pages not filmed: 18-19, 32-39, 58-145, 148-163, 166-175, 178-187, 190-197, 200-201, 204-213, 216-219, 222-225, 228-235, 238-249, 252-267, 270-273, 276-281.

Electricity vs Gas ~~as~~ general illuminants

The gas interest of the world
Early history adverse opinion
scientific men, its gradual rise
to be one largest industry in the
world, to illustrate its magnitude as
compared other industries



Money invested in the US. Eng
the Continent, & bal world — favorite
investment —

Defects as Domestic illuminant - but supremacy over other combustion methods
Danger. = great cost piping house - leakage
Suffocation (get statistics) defects burners
rapid deterioration. Optics of Eye effect
~~[illegible]~~ inconstant illumination

Object E to effect exact imitation
of all done by gas ~~[illegible]~~ so as to replace
lighting by gas by ~~[illegible]~~ lighting

by Electricity

to improve the illumination to such an Extent as to meet all the requirements of Natural Artificial & Commercial Conditions

A general system of distribution only possible way to meet requirements economical illumination Electric distribution analogous to distribution of gas and water —
The accomplishment & perfection of a general system its readiness for introduction only awaiting business men of Energy & Capital

as isolated illumination in Mills etc outside the limits of gas distribution of cities, & special illumination for advertising & other purposes in cities of which a small per cent of the total illumination, and so of not general interest for the public we shall leave the consideration of the rest this book

The creation of a new industry opening a wide field for profitable investment of capital -

Its only effect on gas investment being to gradually cause the present gas interests to cease the manufacture of illuminating gas & go into the manufacture & distribution of heating gas

The advantages of heating gas - its cheapness, the market that could & would be created the effect being to not only not effect the enormous invested

interest of gas to actually
increase its ~~the~~ ~~[illegible]~~ capacity
of Earning.

Table showing amount sold
in Ms yearly in principal cities
world - What its sold for
the money invested per M sold.
Costs in holder Cost distributed

List gas Cos in U.S. small type
Capital etc.

Difficulty getting any reliable
statistics.

Give statistics of every kind
as obtained in our district

In connection with these statistics:
mention premium use Kerosene;
give its cost as against gas,

(

Capability of replacing
gas illumination by electric
illumination in every particular
& general description of the
System

give Estimate table Cost of
plant - Operating Expenses in
large cities = ditto smaller
cities - also where Water power
alone - also where Water power
part time with Steam plant Cases
necessity -

Depreciation of Electric plant
VS gas plant =

In this Connection obtain
gas depreciation from their own
experts + ours from Users
of Boilers Engines

Give all tests at Menlo park

Map —

Indicator tests — dif Engineers

Coal tests

Photometric tests — different competent pers

Life of Lamp tests, ~~dif~~

Dynamo Efficiency test = Clark - Upton - Young & Brackett
also Young & Bckt with Porter Engine

Estimates Examined & reported upon by several good Engineers

Another Review of the whole thing as worked upon upon pure science principles by Rowland - Young Trowbridge

also Rowland on the
possibilities & probabilities of
cheaper production by better
manufacture higher incandescence
without decrease life of lamps

~~Repts~~

~~Repts~~

Cheap meter small Expense
wires allowing poor to use it
1 jet will pay - as one jet
of 16 candles can be subdivided
without loss of economy into
2 of 8 or 4 of 4 candles
this Especially desirable
for the poor

The transmission of power
The RR at Menlo park the Shops
The tests - The generality
distribution of power & light.
How that it doesnt matter if
Elec is used for light or
power = its peculiar advantages
its subdivision into small
power with economy - The
small industries of NYork
present way getting small
power Cost + inconvenience
Extra Rents

Availability of Electric Motors -
measuring aggregated work
on meter = useable night or
day - ~~Impossibility [illegible] that~~
~~gas engines~~ ~~Impossibility~~
Economy of small steam
motors = ~~First~~ Cost gas motors,
their Complication -
Domestic Motor Manufactures
Cuts & description of these
The profits derived from the
Sale of power independent
of light - give table

lessened cost of light
when power sold
give table when various
amounts of light + power
sold

Storage unnecessary - instances
water works - Ocean steam
probabilities with 12 Engines
+ boilers 0.000 —

Statistics of power in our district —

generally poorest dists for light best for power; thus evening up whole city = the Effect of this on investment.

Effect of distribution sale small power will be to create immense amount of small industries

Previous inventors failed -
necessities for commercial
success a accomplished by E,
E great effort not to make a large light
or a blinding light, but a small one
having the mildness of gas
Speak of arc lighting ~~at present~~
~~used mostly [illegible]~~ the
Entirely distinct field large
areas; ~~[illegible] however Edison~~
~~[illegible] for that [illegible]~~
~~light, [illegible] Excelsior~~

E. L. Co. Had the system by
broad patents - gives dates
application patents - patents
allowed & claims -
unassailable by any prior
publication & Claims so

far allowed — Opinion as
to validity in Court of the
patents = opinion well known
men = (negative Evidence —
Preece, Morton & others)

nenclus &
Speak of large works
contemplated for manufacture
Lamps — The Capability to
increase output, it being
new industry necessarily
quality of Lamps improve
~~[illegible]~~ & diminished
price, both tending to
allow of the sale of
illumination more cheaply to public

Notes.

Curve field magnet 3 sizes on
Same plat. - also iron & Copper
investment & labor - also Energy line -
10 pc mention!

Curve Energy (1/2) ft lbs: Candle power +
EMF of A B C & other lamps obtained
Candle by Candle experimentally - Upton
Curve now made with 6 cd. lamp -
also this Curve with different
incandescences

Ditto Motors -

Laws Motor transfer
power on general distribution
System - also in isolated
Case

Graphic representation consumption gas Jany to Dec — also a Curve Shewing ~~Dav~~ average daily Consumption each month of year — one Card Shewing 1 day in June 1 in Jany —

Table fall EMF
Formula —

Laws relating to ft lbs - unit incandescence =

Curve life lamps at different Emf — also different incandescence

Curve Rise Conductivity in Cu
Distution meter =

all other table for meter

Table weight Copper required different distance 100 ohm lamp 16 candles

---

Increased consumption as you go outwardly from station — Show map then make Copper table showing increased investment in Copper as you extend area illumination

Shew graphically by circles illumination by 1 light of 10 gas jets + 10 of 1 gas jet. the gain

Loss by subdivision gas (13). Smaller amount gas dont give proportionate illumination

Represent loss ft lbs in Dynamo & lamps from 1 to 1 to 30 to 1. Giving graphic curve shows gain ~~[illegible]~~ Energy its cost extra ~~investment~~ to obtain the economy. 10 p.c. ~~interest~~.

Represent relative Costs different Illuminants by block or ~~proportion~~ lines one dollar will buy

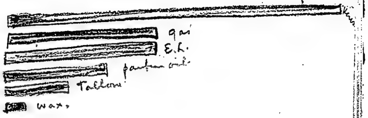


Table Costs Motors

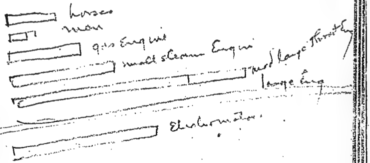


Table ~~b~~ both Curves shewing increased economy by larger Engine higher powers starting 1/4 hp Eng.

Ditto E Motor.

Table relative gas invested for pipe etc

~~for~~

~~[illegible]~~

in figures

Table cost lighting store 50 Kerosene Lamps - labor-wicks Chimneys - Candle power ditto in comparison gas also investment required

Depreciation

Comparative
Size of Conductors ~~Cost~~ in Gas + E
" Supply same areas in City

EL (Gas) - Relative Cost.

O O gas
EL

Yearly depreciation

O (gas)

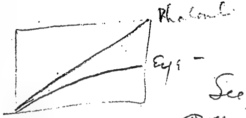
Value if disused & sold in market.

(E.L.) o gas

Relative size in house
EL O gas - Cost;

Curve actual drop Cant be given obtained by experiment .14 machines, 25 lamps ~~on then~~ 1 on. also gradually from 25 down — same if ~~[illegible]~~ / machine Res reduced 1/2 keeping EMF same, —

Photometers approb all Curve of decreased sensibility of Eye to increasing Illumination



See work on Optics Helmholtz etc

in speaking of Ill by E.
Coal Trade Journal of June 16 1880.
says that the application of gas to
Heating Cooking etc would still
return handsome dividends to
the shareholders Even if ~~a source of~~
illumination by it was, wholly superseded
by Electricity

So unpleasant is the effects of the
products of the Combustion of
gas that in the new Madison
Square Theatre Every gas jet is
Ventilated by special tubes to
carry away the products of
Combustion

Opposition to Bessemer -
"Steel by Grams - page 54 -

Candle power Paris gas 12 candles.
Vide Haywoods report on Holborn.
Viaduct. Annuaire G. L. April ~~[illegible]~~ 1879.

Amn Jnl Gasl - May 16/79

McCormicks report.

gas act (English) of 1875 limits
Sulphur Compounds to 30 grains
per 100 CF ammonia 5 grains
actual results last few months
of Lecture, Sulphur 28, ammonia
0.47. Copland Lecture in
B Jnl of Lighting April 29 1879

Cost working gas Engine, attendance
Cost plant etc - annu gas L[illegible]
Sept 16 1880

April 29 1879 Jnl of Gas L British
Lecture by C. Copland, M Inst CE
Late Supt & Engr British Gaslight Co at Hull,
stated. Total invested in world little
over £300,000,000.

See Quotation from Engineering in Coal trade Jnl Mch 79 –

Preeces Lecture before United Service Institute – See Electrician Feby 22/79 – try get original – ground ably for it –

Latimer Clark – Electrician Mch 15 1879 –

Preeces Mathematical assay on EL Phil Mag Jany 1879 – page 29 =

1 Cent 3 mills per 1000 feet
was expense of management
of London Co 1879 —

See Goodwin's statement Experiments
Economy Coal VS Gas Cooking
Am Gas Assn - Apl 2 1880
in proceedings Gas Assn -

The state inspector gas State Mass. finds upon investigation ~~that~~ that the average error of all the meters about which complaints were made was 64/100 of 1 per cent against the consumer. Get Amn gas light Jul March 6 1880. Contains Hinmans full report

Water gas

gas in press room Quebec Chronicle exploded
loss $1000. Feby/80

Chicago Insurance Patrol for 2 months ending
Dec 31 found 217 buildings with
unsafe gas brackets –

Deaths Sensual account.
Deaths safety –
ann g L jnl Nov 16, 1880.

Municipality Report Paris Cost
Gas & Elec Light - Engineering
Jany 31 1879

Analysis of the Metropolitan Gas Cos accounts by Mr Field for 1879.

Complete set Amn full gaslighting
" " British
" French

Fontaine Book -

Haywoods Report on result Lighting Holborn Viaduct,

Also report Costs on Thames Embankment L

~~Smiles lives of the Engineers~~

= Brush article in Van Nostrand)

Poors Manual of Railroads -

Life of Stephenson by Saml Smiles.

J Francis,, History English Railways ordered to lure

Transactions of the British assn of gas Managers full set if possible -

Price Glas dif cutis · 176

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39

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